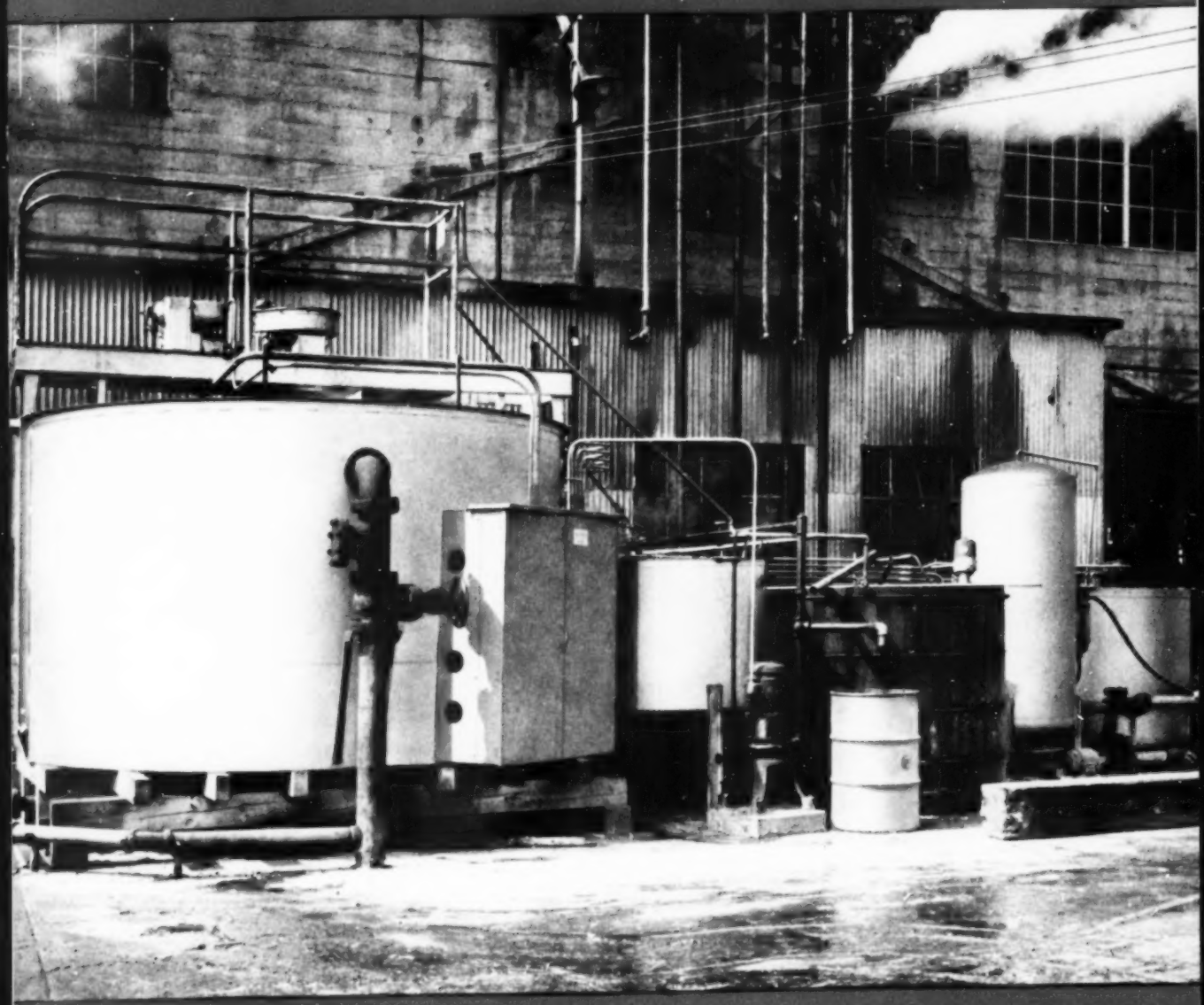
# WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



APRIL, 1953

Pressure-Floatation Method of Waste Treatment....

Doing a job on rendering wastes for Western California Products Co.

# Why does THIS GATE always draw "TOP BOX OFFICE?"

## CHAPMAN *Standard* SLUICE GATES

Any investment that's been proved safe, over the years, is sure to be a "top draw" on the list of anyone who's looking for his money's worth. And that's why Chapman Sluice Gates are the top choice of shrewdly managed waterworks, sewage works and flood control projects all over the country.

There are 3 good reasons for this: *First,* Chapman's Standard Line includes many types and sizes that are usually expensive special-order jobs. *Then,* installation is quick and easy (with *any* type of operating control) because stems and couplings don't have to be match-marked. *Finally,* any servicing needed can be done on the job, without alterations. See what Chapman Standard Sluice Gates can save for your project. Write for catalog No. 25.

***The Chapman Valve Mfg. Co., Indian Orchard, Mass.***

# Evansville Installs CLAY PIPE IN $5,000,000 "URBAN HEALTH INSURANCE" PROGRAM

Over 50,000 newcomers to booming Evansville, Ind., get permanent sewerage facilities as more than 37 miles of Vitrified Clay Pipe are installed under a bond-financed program that includes the city's first sewage treatment plant.

"Urban Health Insurance"—that's what Evansville, Ind., newspapers call the $5,000,000 Clay Pipe sewerage project that will serve the new homes, schools, and hospitals within the expanding city limits. Defense industries have drawn more than 50,000 people into Evansville in recent years. The 200,000-foot Vitrified Clay Pipe installation provides them with *permanent* sewerage protection.

Clay Pipe is first choice of city engineers and building contractors all over the country, because it's *guaranteed for 50 years.* Clay Pipe can't be corroded or weakened by strong detergents, corrosive fluids, sewage gases, or electrolytic soils. It never "ovals" or squashes out. And it meets the needs of the future . . . can't be affected by wastes from home garbage disposal units or new industries. Whenever you specify, buy, or install sewer pipe, be sure it's Vitrified Clay — the pipe that *never wears out!*

**NATIONAL CLAY PIPE MANUFACTURERS, INC.**
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***ESSENTIAL • ECONOMICAL • EVERLASTING***

*Vitrified*
CLAY
CLAY PIPE NEVER WEARS OUT!
PIPE

C-153-3

THE installation of Permutit automatically controlled zeolite water softeners economically solved the problem of hard water for this Florida city. The Automatic Regeneration feature saves valuable man hours, eliminates the possibility of costly human errors, and assures a constant supply of clear, soft water.

Well water of 20 grains hardness is softened by Permutit Q, the high capacity sodium cation exchanger, which in this installation is regenerated with brine from a nearby salt well.

Consulting Engineers, Russell & Axon of Daytona Beach, Florida, planned the layout and recommended Permutit Automatic Equipment and high capacity Permutit Q. For information concerning your city's water problems write to: THE PERMUTIT COMPANY, Dept. W-4, 330 West 42nd Street, New York 36, N. Y.

WATER CONDITIONING HEADQUARTERS
FOR OVER 40 YEARS

PERMUTIT®

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# WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT


## COMING ARTICLES


Inter-relationship of Water Supply and Pollution Control ..... *Capen*
Practical Electricity for the Plant Operator ..... *Smith*
Iron and Manganese Removal ..... *Nordell*
Simplified Determination of Hydraulics of Main Extensions ..... *Taylor*
Improvements to the Winston-Salem Water Supply ..... *Harris*
Methods of Treating Reservoirs with Copper Sulphate ..... *Derby*
Selecting the Proper Machine Billing System ..... *Maffitt*
Safety in Sewage Works Operation and Sewer Maintenance ..... *Van Kleeck*
Selection, Operation and Maintenance of Valves ..... *Kauffman*
Water Works Practices (Short-course type articles*) ..... *Symons*


*In this issue is one of a series of short-course type articles on *"Sewage Works Practices"* by Prof. Don Bloodgood. Articles of the Symons and Bloodgood series will appear in alternate issues.


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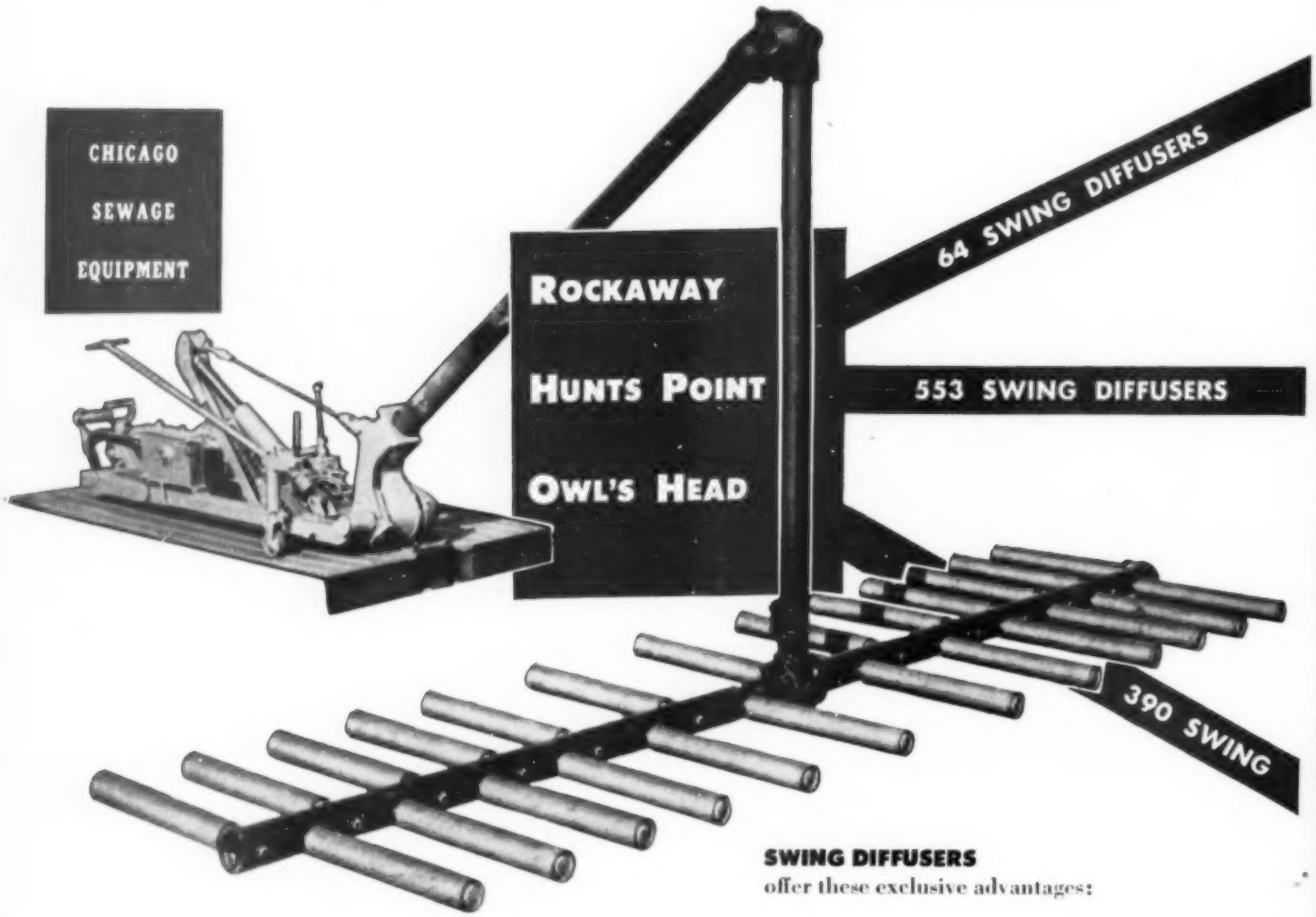
# SWING DIFFUSERS

## INSTALLED FOR AERATION IN ALL THREE NEW YORK CITY'S NEWEST SEWAGE TREATMENT PLANTS

To the New York Department of Public Works, its Division of Sewage Disposal, and to the consulting engineers who designed these sewage projects, Chicago Pump Co. joins the entire sanitary engineering profession in a tribute acknowledging their outstanding achievement.

We are justifiably proud that Swing Diffusers were selected for all three plants where aeration is required. Once again Swing Diffusers have been selected by leading sanitary engineers, because they provide the most effective and economical method of aerating sewage.




**SWING DIFFUSERS**
offer these exclusive advantages:

**PRECISION DIFFUSER TUBES** are cleaned and restored to new condition easily and at low cost . . . insures uniform air rate to each tube by integral inlet control orifice . . . gives uniformity of fine bubble diffusion over the entire active surface of the diffuser to provide greater surface areas of contact.

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**SEWAGE EQUIPMENT DIVISION**

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Flush Kleen, Screw-Feller, Plunger Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

Four 50′ Chicago-Wiggins Pontoon Covers and Chicago Standardaire Blower also specified for this plant.

## 1452 PRECISION TUBES

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## 10,097 PRECISION TUBES

Hunts Point Aeration Tanks N.Y. Dept of Public Works, Division of Sewage Disposal. Greeley & Hansen, Consult. Eng.

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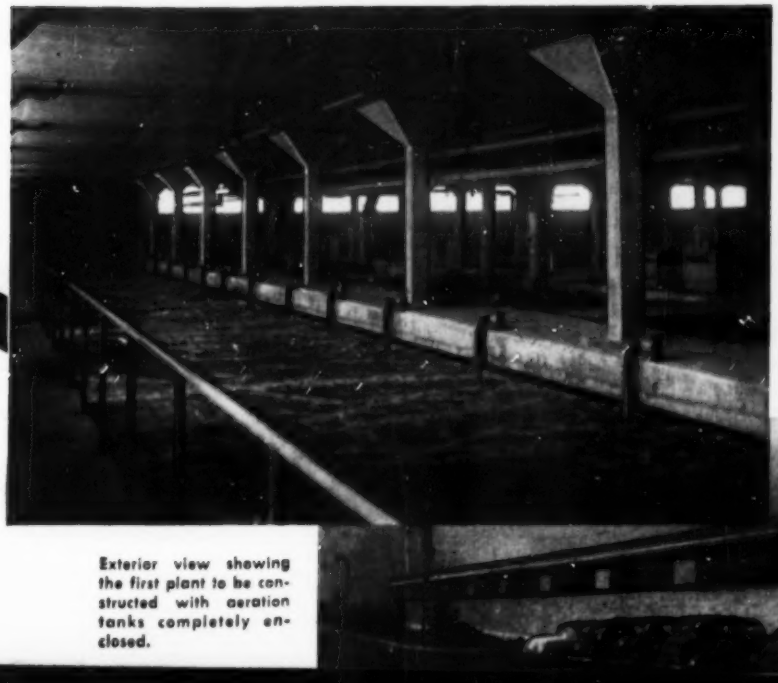


Owls Head Covered Aeration Tanks N.Y. Dept. of Puolic Works, Division of Sewage Disposal.

Exterior view showing the first plant to be constructed with aeration tanks completely enclosed.

**Transite Pipe** is a product of modern engineering and research. Shown above is one of the buildings at the Johns-Manville Research Center at Manville, New Jersey.

*Transite is a registered Johns-Manville trade mark

# Johns-Manville TRANSITE

## TRANSITE PIPE last longer California city streets?

**Transite Pipe** was first installed by this California city nearly 20 years ago. Its lasting strength and high corrosion resistance have enabled it to outlast pipe previously used several times over.

# Research designed it for lasting strength

TODAY, ACROSS THE COUNTRY—under countless city streets like the one shown above—Transite® Pressure Pipe is doing a highly efficient job of transporting water . . . often under conditions so adverse to ordinary pipe that engineers marvel at Transite's ability to stand up through the years!

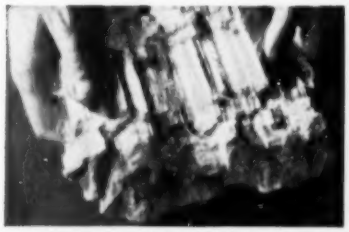
The reason? *Lasting strength!*

Not only does Transite Pipe have the *initial* strength that's needed in a pipe intended for use under busy city streets. Equally important, it has the *lasting* strength that enables it to survive continued corrosive attack, year after year . . . to keep on giving the same dependable, economical service to the community as the day it was installed.

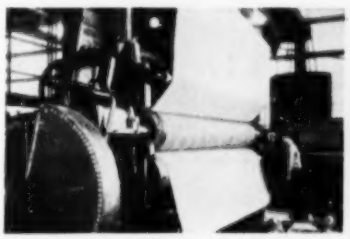
This highly important quality of lasting strength is one of many notable inherent advantages of a pipe engineered with modern water transportation requirements in mind. Transite's Simplex Couplings reduce leakage losses to a minimum, provide flexibility to help relieve the line of soil stresses and traffic loads. Its light weight makes for easier handling and effects substantial savings during installation. Its smooth interior assures a high coefficient of flow (C=140) and, because Transite can never tuberculate, helps keep pumping costs low through the years.

Why not get all the details . . . find out how this modern-engineered-for-the-job asbestos-cement pipe can help solve your water-line problems and *save you money?* For full information, write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS MANVILLE JM PRODUCTS



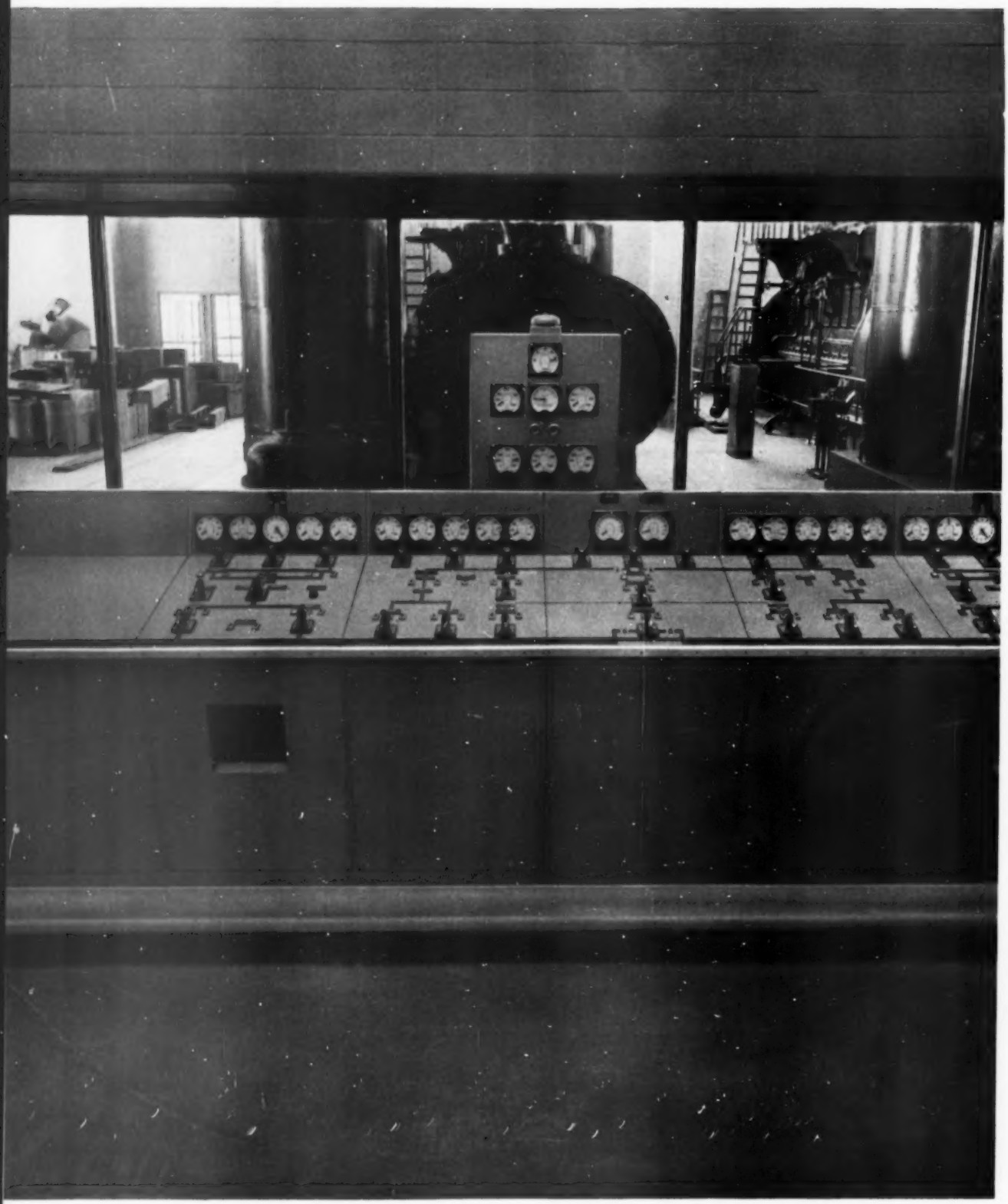
**Tough, strong asbestos fibers reinforce Transite Pipe—contribute to its high corrosion resistance and lasting strength.**



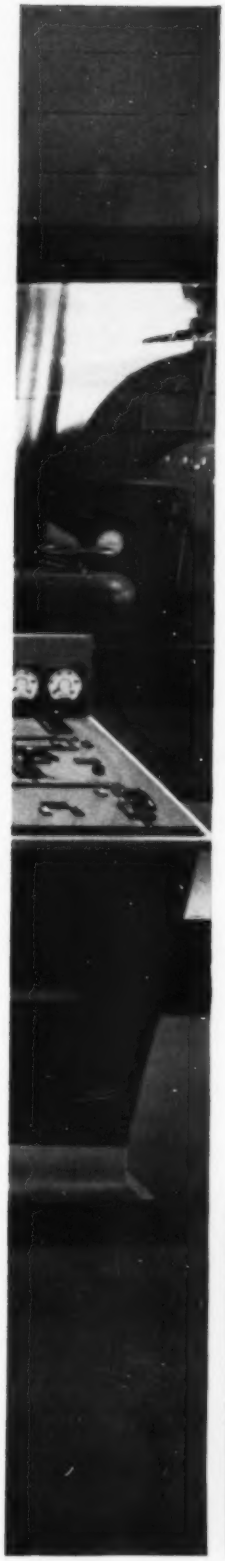
**On machines like this, the asbestos-cement-silica mixture is "built up" under heavy pressure into a dense, homogeneous pipe structure.**

**Transite's flexible Simplex Couplings help relieve the line of excessive flexural stresses—an added safeguard against pipe failures.**

# asbestos-cement PRESSURE PIPE



***New Hunts Point Sewage Control Plant,*** Bronx, New York, has a design capacity of 120 million gallons per day (mgd). Future plant expansion will ultimately increase capacity to 150 mgd. J. Livingston & Co., New York City, electrical contractor.



# Sound planning and unit equipment assure reliable power at Hunts Point

Service continuity is extremely important to the new 120-mgd Hunts Point Sewage Disposal Works—significant step in the City of New York's pollution control program. Shutdowns would affect a tributary population of 770,000 in a 15,613 acre area.

Based on a careful study during the blueprint stages, engineers for the Department of Public Works, City of New York, designed a duplex electrical distribution system. It assures reliable service by providing dual feeders, switching capacity and transformers, plus electrical tie breakers.

Supplementary power is available from two by-product gas engine generators—each rated 875 kva. These can also be operated as blower drive motors.

Westinghouse power, switching and control equipment play a vital part in the duplex system. Co-ordinated specifically for Hunts Point, this completely unitized line installed easily. It simplifies maintenance due to accessibility of breakers and controls. It assures easy, economical expansion because of its inherent flexibility.

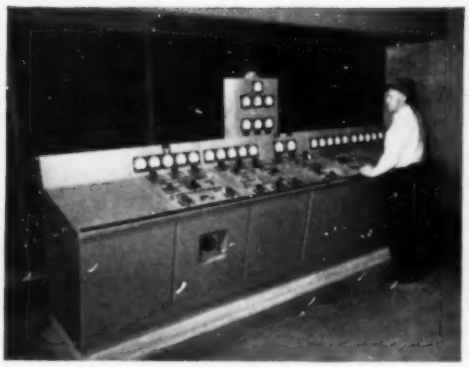
Hunts Point is another instance of Westinghouse participation in sewage control projects—ranging from special engineering assistance to supplying a complete line of electrical distribution equipment.

Call your nearest Westinghouse office for examples in your own area. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

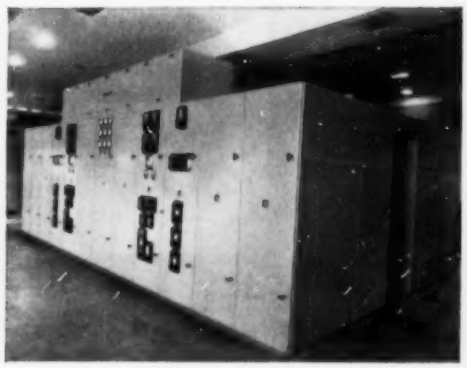
J-94962

YOU CAN BE SURE...IF IT'S

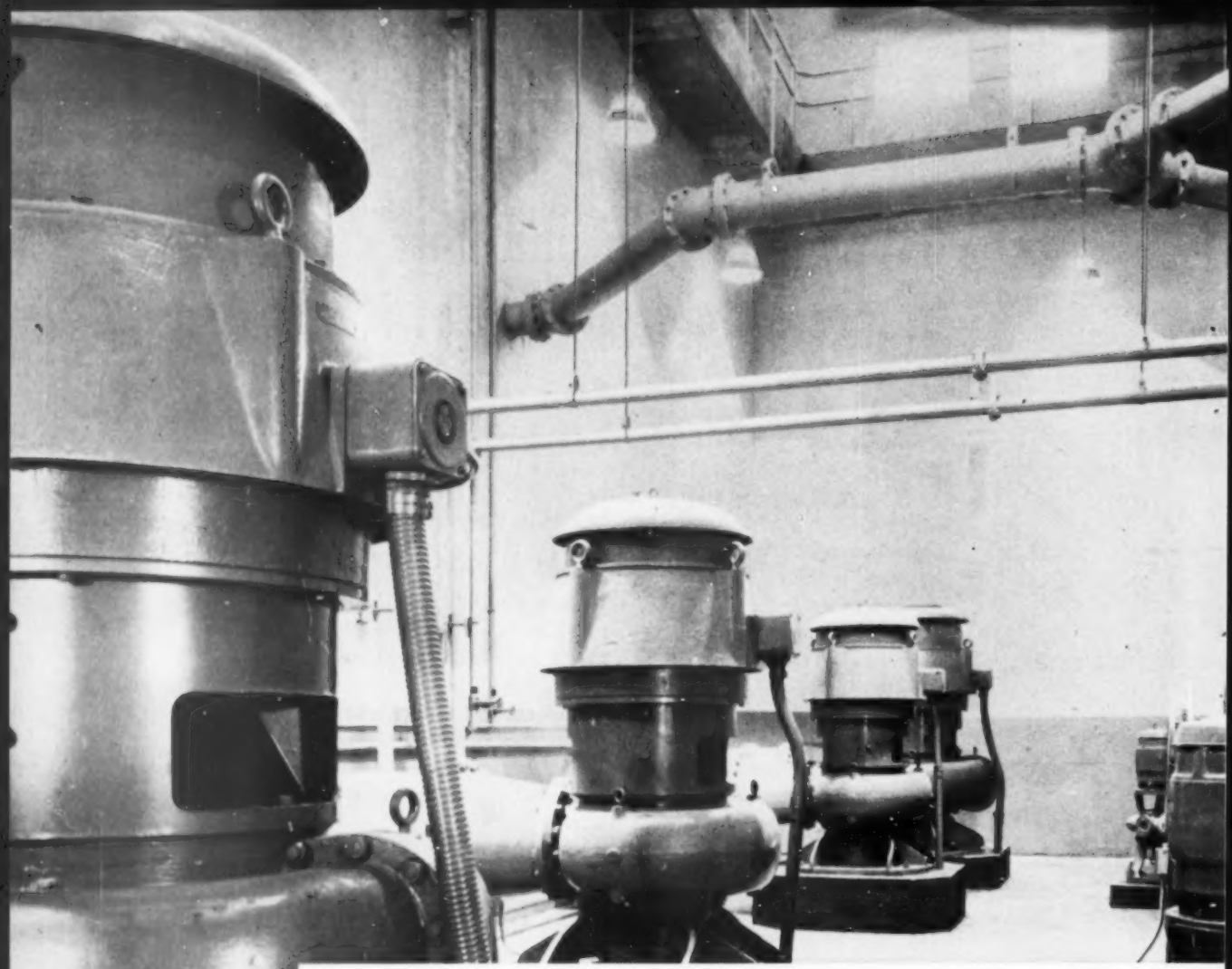
Westinghouse



***Westinghouse Main Control Benchboard*** provides finger-tip control of virtually all plant operations. From it, utility and plant power can be controlled through remote switching of feeders and transformers in both systems.



***Westinghouse Indoor Metal-Clad Switchgear,*** 4160 volts, is located back to back with similar switchgear which controls utility power supply. Factory assembled and tested, this compact unit installed easily and saved building space.



# *Keep This Angle in Mind*

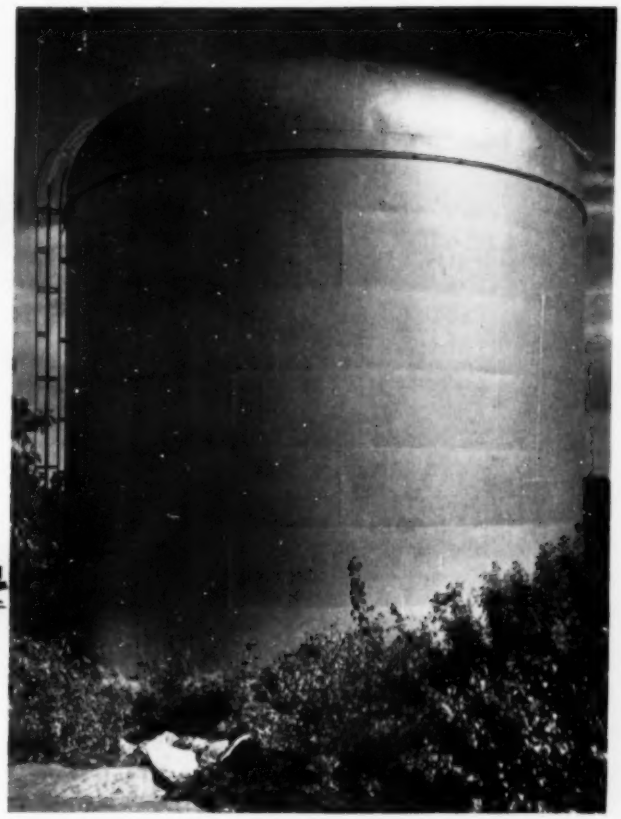
. . . that when you want to move big volumes of sewage or storm water *economically,* your best bet is Fairbanks-Morse *Angle*flow Pumps. Designed for maximum plant efficiencies where large quantities must be pumped against moderate heads, these dependable pumps give you a new high in service . . . a new low in operating and maintenance costs. Wide, unobstructed passages through impeller and volute make them especially suitable for handling debris-filled water. Sizes range from 8 to 54 inches . . . capacities up to 80,000 g.p.m. For complete information see your local Fairbanks-Morse Branch or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

**FAIRBANKS-MORSE,**

***a name worth remembering***

PUMPS • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • SCALES
HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS

# Meet Varying Water Needs in Maine Resort Area with a HORTON* STANDPIPE



Population in the Biddeford, Saco, Old Orchard and Pine Point area swells from a winter average of 34,000 to a summer peak of around 103,000. To help meet the needs of this large summer population, the Biddeford & Saco Water Company recently installed a 1,250,000-gal. Horton standpipe.

The new standpipe is located on the southwest side of the City of Biddeford and directly serves the surrounding 15 sq. mile area. Indirectly, it also benefits the entire 80 sq. miles of the system by adding greatly to the overall storage in the distribution system.

When a municipal water system must be expanded to meet increased demands due to a growth in population or a seasonal influx, the most practical answer to the problem is the installation of Horton standpipes or elevated tanks. The incorporation of Horton structures into a system is usually easier and more economical than expanding pumping stations, replacing existing mains, etc.

Horton standpipes and reservoirs for municipal water service are built in standard capacities up to 10,000,000 gallons in accordance with AWWA specifications. Horton elevated tanks are built in standard capacities from 5,000 to 3,000,000 gallons. There is a design and size for every municipal water need. For estimates or quotations, please write our nearest office. State capacity, dimension, location and height to bottom for elevated tanks. There is no obligation.

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**HORTON**

WELDED STEEL

STORAGE TANKS

**CHICAGO BRIDGE & IRON COMPANY**

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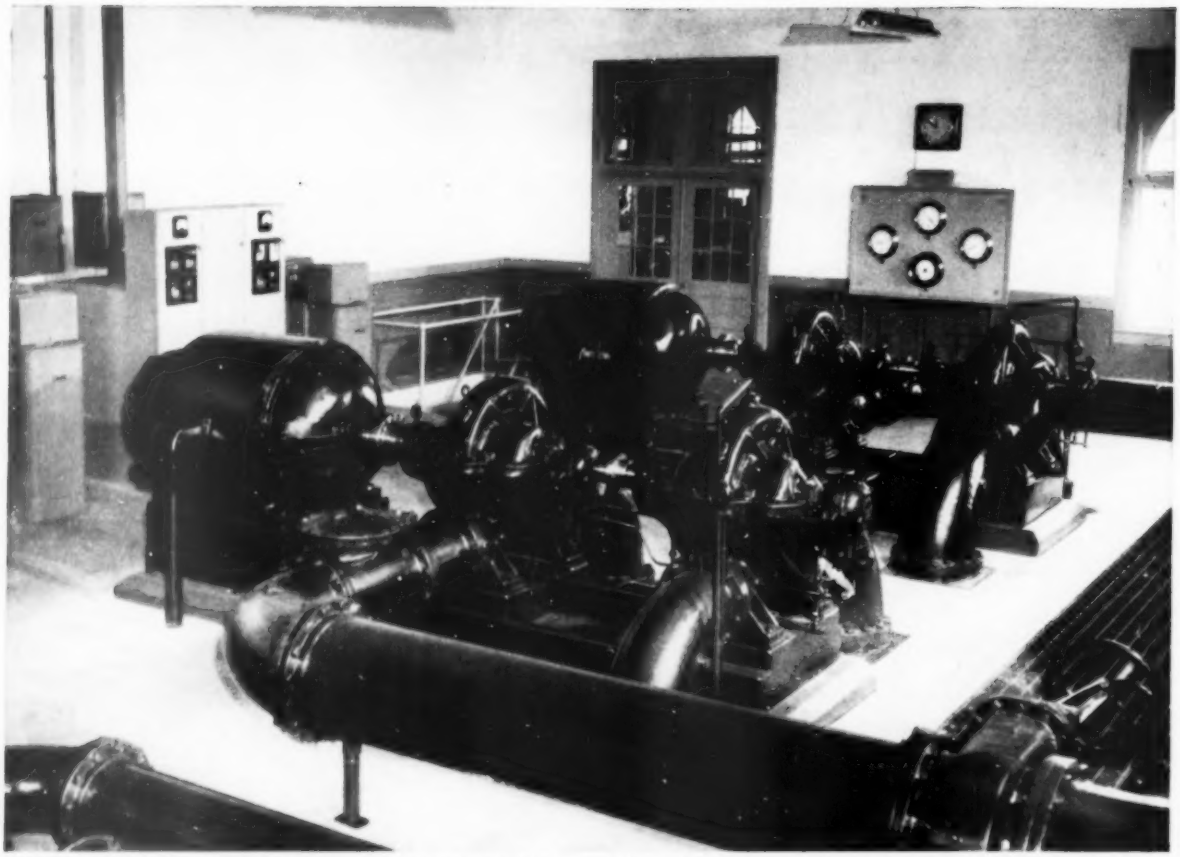
| Birmingham 1 | 1596 North Fiftieth St. | Los Angeles 17 | 1555 General Petroleum Bldg. |
| Boston 10 | 10'8—201 Devonshire St. | New York 6 | 3390—165 Broadway Bldg. |
| Chicago 4 | 2198 McCormick Bldg. | Philadelphia 3 | 1644—1700 Walnut Street Bldg. |
| Cleveland 15 | 2262 Midland Bldg. | San Francisco 4 | 1583—200 Bush St. |
| Detroit 26 | 1551 Lafayette Bldg. | Seattle 1 | 1350 Henry Bldg. |
| Havana | 402 Abrev Bldg. | Tulsa 3 | 1646 Hunt Bldg. |



**RECENTLY INSTALLED WORTHINGTON PUMPING UNITS** at Columbia, S. C., Water Works. Each unit handles 10 million gallons per day at a 350-foot head. Other Worthington equipment at Columbia includes two 3½-million gallon per day duplex water-power driven pumps, two 18-million gallon per day electric-motor driven pumps, and one 5-million gallon per day series pump.

# Columbia, S. C., uses 7 Worthington pumps

## *Two 10-mgd units newest addition in 46 years of Worthington pump operation*

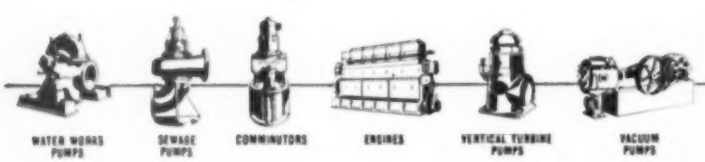
Columbia knows how Worthington equipment performs. The day-in, day-out dependable performance it has chalked up for 46 years is typical of the job Worthington pumping installations are doing everywhere.

It's pumping installations in average-size cities like Columbia, S. C., spread across the country from Maine to Florida, from New York to California, that have built up Worthington's reputation for the finest in water-works pumps.

Whether your city is large or small, Worthington can supply exactly the equipment for water-works pumping, sewage treatment or power generation. Remember, Worthington means *all* public works equipment under *one* responsibility.

Write us today, stating your municipality's requirements. We'll be glad to make recommendations at no obligation. Worthington Corporation, Public Works Division, Harrison, N. J.

W.2.2




**WORTHINGTON**

Public Works Equipment

**All Major Public Works Equipment Under One Responsibility**

# Now 3 more added to the scores of

# ELEVATED TANKS by PITTSBURGH • DES MOINES

## on Long Island, N.Y.

**FRANKLIN SQUARE, *Long Island, N.Y.***
**500,000 Gallon Double Ellipsoidal Tank.**
**Diameter 50 ft, head range 39 ft, height to bottom 95 ft.**

**HEMPSTEAD, *Long Island, N.Y.***
**1,250,000 Gallon Radial Cone Tank.**
**Diameter 74 ft, head range 40 ft, height to bottom 110 ft.**

**ALBERTSON, *Long Island, N.Y.***
**500,000 Gallon Double Ellipsoidal Tank.**
**Diameter 50 ft, head range 39 ft, height to bottom 126 ft.**

Pittsburgh-Des Moines Elevated Steel Tanks serve densely-settled Long Island from the great metropolitan center of Brooklyn, through the busy commuter towns, to remote villages in the eastern rural areas. The dependability and satisfactory performance of these structures recommend them continually to communities desiring improved water service. We will be glad to supply complete details and consult on your requirements, upon request.

**PITTSBURGH • DES MOINES STEEL CO.**

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

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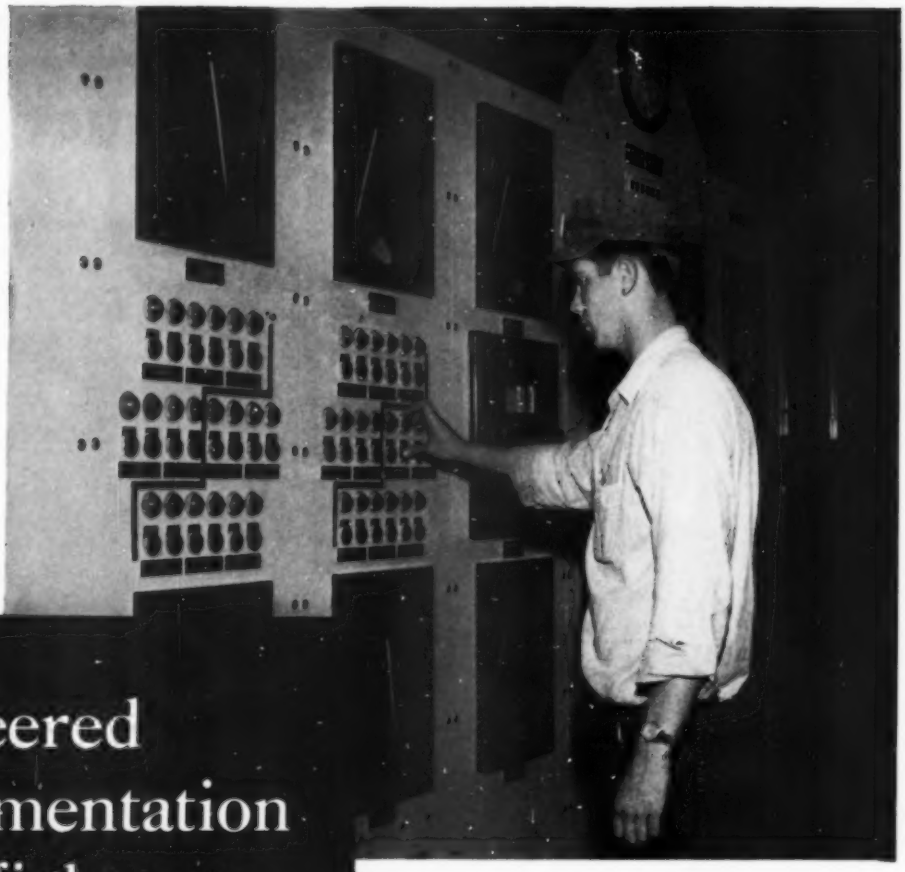
| CHICAGO (3) | 1222 First National Bank Bldg. | SEATTLE | 526 Lane Street |
| LOS ANGELES (48) | 6399 Wilshire Blvd. | SANTA CLARA, CAL. | 625 Alviso Road |



# engineered instrumentation helps fight water pollution

*Battery of digesters is efficiently controlled from this panel of Honeywell instruments, at the Hyperion plant, Los Angeles. Combustible gas from the digesters is used as fuel for the internal combustion power plant.*

THE city of Los Angeles called on the most advanced engineering techniques to solve their big waste-disposal problem. The result: the Hyperion Activated Sludge Plant, which daily processes 350 million gallons of sewage into clear water that can be discharged into the ocean without danger of contamination.

Honeywell control instrumentation, although it amounts to only a minor percentage of total plant cost, makes invaluable contributions to the smooth, efficient operation of this plant, from automatic operation of bar screen rakes to control of gas firing of sludge driers.

Honeywell's engineering service, representing many years of experience in this specific field, is ready to design custom-fitted instrumentation for your water or waste-treatment plant. The broadest line of measuring and controlling systems—for filtration, aeration, drying, flotation and related processes—is at your disposal.

Our local engineering representative is well qualified to discuss your requirements with you and your consulting engineer. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Philadelphia 44, Pa.

● REFERENCE DATA: Write for reprint of article, "$42 Million Sewage Plant Pays Much of Own Way"

MINNEAPOLIS **Honeywell**

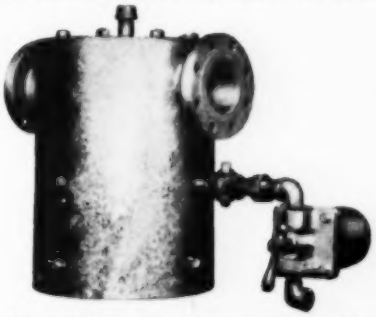
BROWN INSTRUMENTS

*First in Controls*

# TRAPPED!

✓ **Trapped—flames, pressures, sediment and moisture in service lines, that would otherwise play havoc with proper functioning of the digester gas system at sewage treatment plants. This soundly engineered P.F.T. gas safety equipment assures positive protection and trouble free operation. Detailed in Bulletin 321.**

***P.F.T. Model No. 91 Flame Traps.*** As dependable and responsive as the fuse in an electrical circuit. Honeycomb cell in head of trap permits gas to flow through, but not flame. If flame does not quickly burn out, resultant heat melts "fuse", causing spring loaded valve to close, shutting-off flow of gas from digester. Available in 2", 3", 4" and 6" pipe sizes.



***P.F.T. Model No. 1021 Accumulators for Condensate and Sediment.*** Traps condensate sediment and removes slime producing foreign matter, keeping gas lines free. 5-gallon capacity. Inspection pipe to determine accumulation. Top removable for cleanout. Sizes 2" to 4".

***P.F.T. Model No. 92 Pressure Relief.*** Sensitive, weighted diaphragm-operated relief valve, designed to maintain pressure in gas system and automatically relieve excess gas to be burned in waste gas burner. Available in sizes 2" to 6".

***P.F.T. Model No. 420 Low Pressure Check Valve.*** For multiple digester installations. Prevents backflow of gas into digester when handhole or sampling well is opened for inspection or sampling. Available in sizes 2" to 4".

***P.F.T. Model No. 466 Drip Trap.*** Installed at all low points in gas piping system for removal of condensate. Gas cannot escape when handle is turned to drain trap.

***P.F.T. Waste Gas Burners.*** Employed to burn excess gas to eliminate odor nuisance and hazard. Refractory baffled combustion chamber. Pilot light. Insulated pedestal. Sizes 2" to 6".

**P.F.T.**

## PACIFIC FLUSH TANK CO.

*Waste Treatment Equipment Exclusively Since 1893*

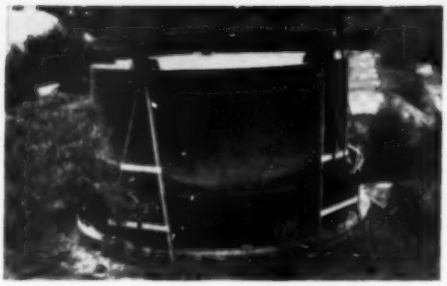
**4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS**

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

# "Over 9 years' good protection from corrosion with BITUMASTIC No. 50"

*says*

*C. P. KETLER, Chief Engineer, Village of Rockville Centre, N. Y.*



IN 1942, the Village of Rockville Centre reconditioned the gas holder in its sewage plant. Because the interior was badly scaled and pitted, it was sand blasted, and the surfaces were given two coats of Bitumastic® No. 50—a heavy-duty protective coating that prevents corrosion.

This year, the plant was dismantled as arrangements had been made to have the sewage handled by a Sewage Authority. Mr. Charles P. Ketler, Chief Engineer of Rockville Centre, examined the interior surfaces of the gas holder. Here's what he reported: "Both the protective coating and the gas holder were found to be in excellent condition. We had over 9 years' good protection from corrosion with Bitumastic No. 50."

A good record, particularly when you consider that the interior surfaces were exposed to gas that often produces accelerated corrosion. There are two principal reasons why Bitumastic No. 50 gives such effective protection: 1) Each coat is *extra thick*, equalling 5 to 8 coats of conventional paints, and 2) It has a base of coal-tar pitch that is unaffected by most acids and alkalies.

Besides being used on metal, Bitumastic No. 50 protects concrete and masonry, too. Koppers makes a family of protective coatings, formulated to meet varying conditions. Send for copy of booklet.

## SEND FOR FREE BOOKLET!

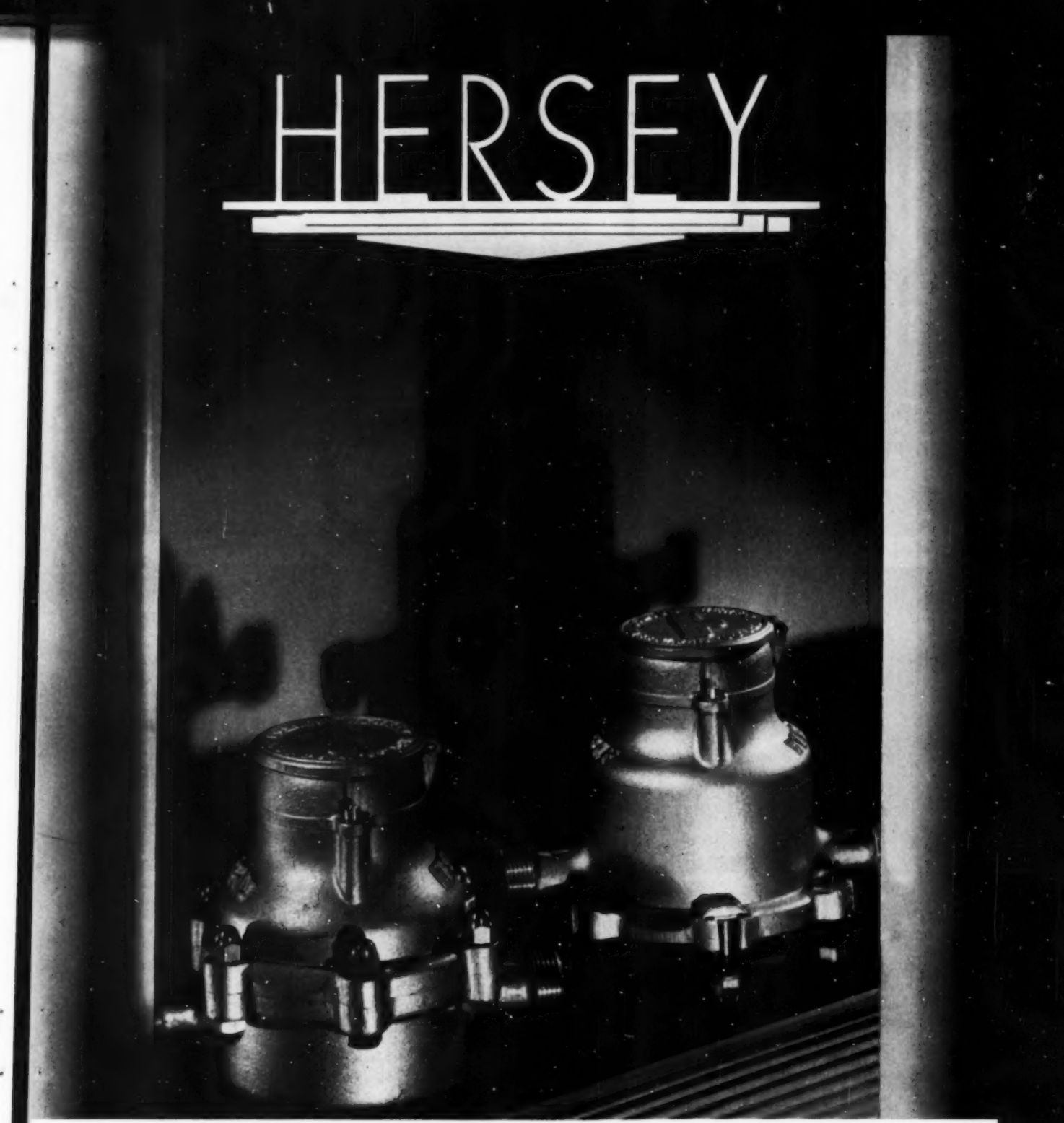
Our new booklet describes Bitumastic Protective Coatings for sewage plant installations. It will help you select the right protective coating to prevent corrosion and deterioration. It shows how you can protect all sewage-plant equipment, above or underground, metal or concrete. Send for a copy. No obligation, of course.

KOPPERS BITUMASTIC PROTECTIVE COATINGS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 461-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.




## HERSEY WATER METER POPULARITY

### Is Greater Today Than Ever

**REASON: The basic engineering design has never been equaled**

## HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
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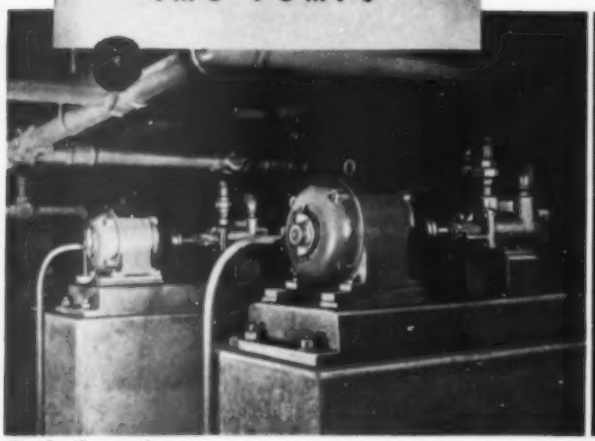
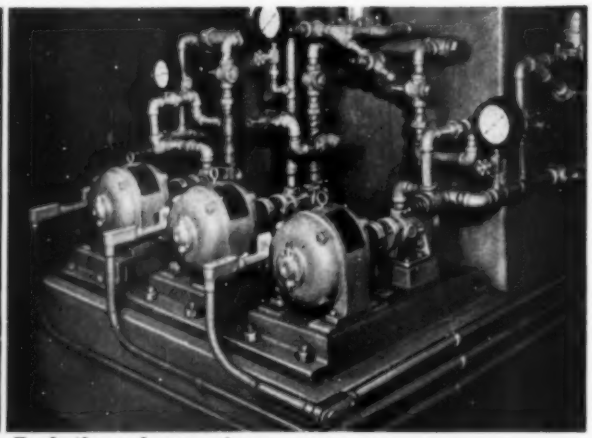
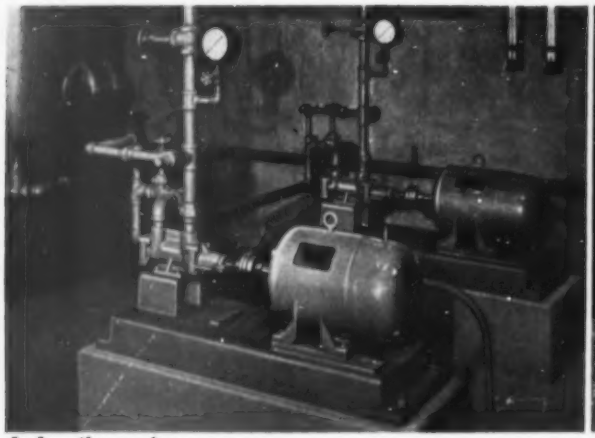
# DE LAVAL IMO PUMPS *hold down 4 jobs at Owl's Head*



*Fuel oil transfer*



*Fuel oil supply to engines*



*Lube oil transfer*

*Lube oil circulating*

Again De Laval IMO rotary pumps prove their versatility. Eighteen of them are handling all the fuel and lube oil services for the six National Supply Company dual-fuel engines in the new Owl's Head sewage treatment plant in Brooklyn, New York.

The unique IMO design—*with only three moving parts*—assures long, trouble-free performance. IMO pumps are quiet, pulsation-free, compact and excellent for direct-connected high-speed operation.

Whether your power source is dual-fuel, gas or diesel engine, or oil-fired steam, be sure to specify IMO pumps for your next oil handling job. Use them in high and low pressure fuel oil burner sets, pumping fuel oil to burners, unloading and transferring fuel and diesel oil, handling oil for lighting off service and providing pressure lubrication on pumps and turbines. Send for Bulletin LG showing complete IMO line for capacities to 1,000 gpm at pressures to 500 psi and for capacities to 150 gpm at pressures to 1,500 psi.

See us at the show
BOOTH 60

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
*824 Nottingham Way, Trenton 2, New Jersey*

DL-157

# Here's a Boom That REACHES For Extra Jobs

The all-hydraulic Bucyrus-Erie 3-ton Hydrocrane with telescoping boom reaches into windows and box cars . . . over fences . . . under beams and overhanging branches . . . between wires and rafters — without moving crane an inch! Boom extends and retracts a distance of eight feet.

The outstanding advantages of telescoping boom plus precision hydraulic control and high-speed travel combine to make the Hydrocrane ideal for setting water and sewer pipe . . . digging manholes . . . emergency pipeline leak repair . . . cleaning catch basins — dozens of digging and lifting jobs.

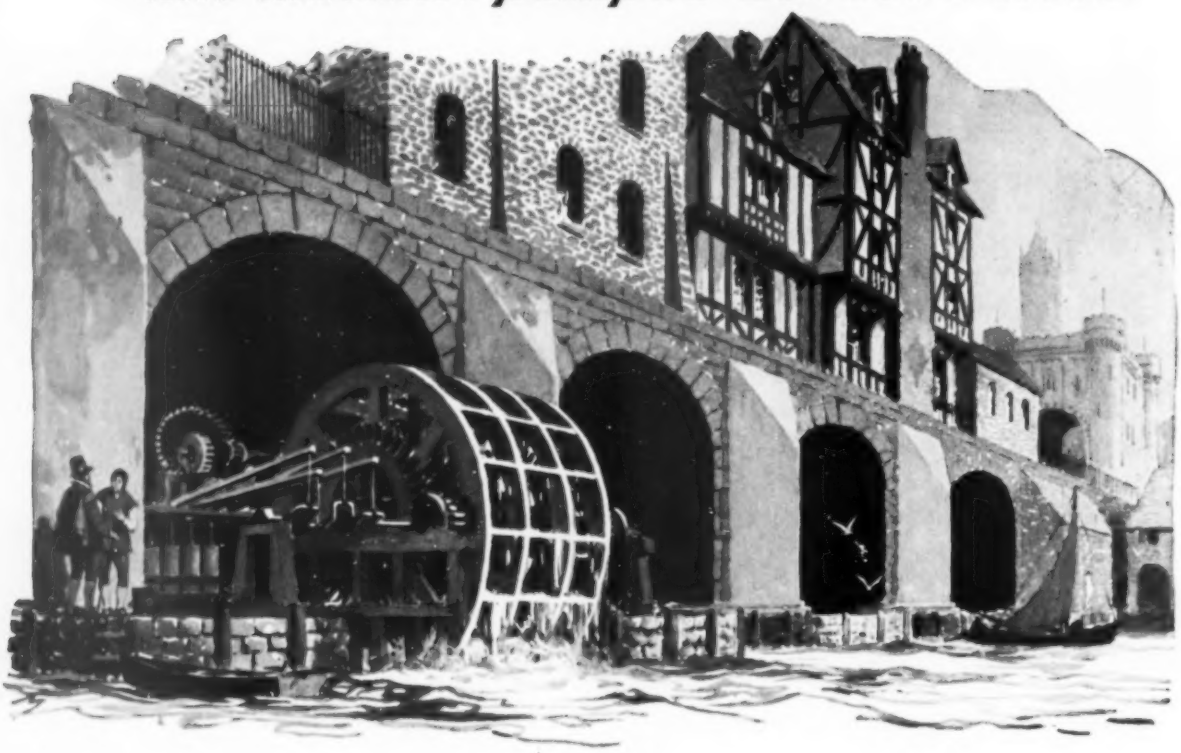
In addition, crane can be quickly converted to hoe front-end in the field for pipe-line trenching . . . digging meter and hydrant pits . . . miscellaneous excavating. Conversion has actually been made in as little as four man-hours. See your Hydrocrane distributor for complete details.

161H52

Here the Hydrocrane cleans catch basins with special catch basin cleaner attachment. Every work function fully hydraulic — boom hoist and swing, load hoist, boom telescope, outrigger set and retract, bucket close.

BUCYRUS ERIE
HYDROCRANE
South Milwaukee, Wisconsin

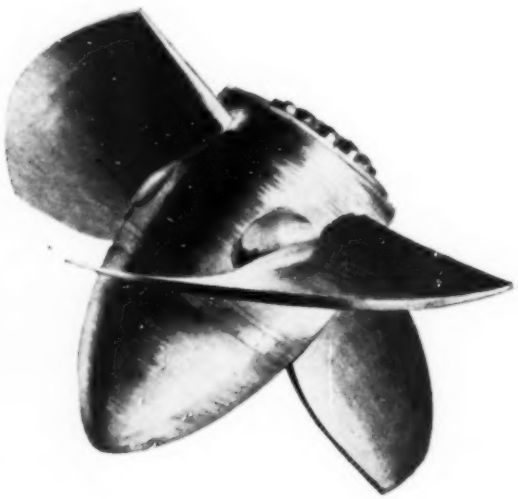
# *in 1582 when this machine pumped London's Water*



**SKIP the centuries!**

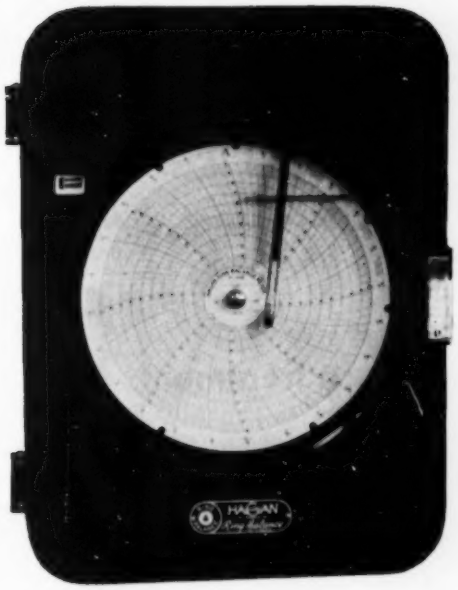
**In this country alone there are systems that would shame London's great contribution, even in our smallest towns.**

**A Parade of Progress in which Smith Rotovalves and Axial Flow Pumps have marched in the very forefront! Good reason for putting your hydraulic problem in our hands, isn't it?**



## S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.



*When you install*

# HAGAN RING BALANCE FLOW METERS

*You install*

*Accuracy*

*Dependability*

*Durability*

*Versatility*

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING LABORATORIES

Hagan Ring Balance Flow Meters give dependable readings over the chart range, and give good response at low flow rates.

The calibration may be checked under full static pressure conditions by a simple check-weight method. One man can check calibration in a few minutes.

The simplicity of design, coupled with sturdy construction, assure long meter life and low maintenance costs.

The Hagan Ring Balance Meter is the most versatile meter made. Whatever your metering problems, our engineers will be glad to show you how Hagan Meters can help you solve them.

## HAGAN CORPORATION

**HAGAN BUILDING • PITTSBURGH 30, PA.**

**Hagan Corporation**
**Hagan Building**
**Pittsburgh 30, Pennsylvania**

Please send me further information on Hagan Ring Balance Meters.
I am particularly interested in _____

NAME _____
POSITION _____
COMPANY _____
STREET AND NUMBER _____
CITY _____ ZONE ____ STATE _____

WS-4

**You'll have less infiltration . . .**

**reduce treatment costs . . .**

**conserve plant capacity . . .**

**Total infiltration** in an all-Transite sewer system (over 5 miles of pipe) was so little the trickle had to be measured through a 3-in. pipe inserted in the Parshall flume!

# —ALL because of this RING-TITE JOINT used with Transite Sewer Pipe

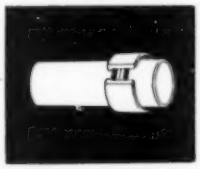
THE reduction of ground-water infiltration brought about by the Ring-Tite® Joint—now standard on all sizes of Transite® Sewer Pipe—can lead to a number of cost-saving results.

For example, on one recently installed Ring-Tite System using 28,540 feet of Transite Sewer Pipe, in diameters of 6 through 18 inches, the infiltration per inch of diameter, per hour, per mile of pipe came to a mere 0.85 gal. This low infiltration (including that from manholes and connections to house sewers) was achieved despite the fact that a considerable portion of this installation was below the prevailing ground water table. (For specification purposes, an infiltration allowance of 10 gallons per inch of diameter, per hour, per mile of pipe may be used with Transite Sewer Pipe.)

Obviously, such minimum ground-water infiltration helps reduce the load on treatment plants, cuts down on treatment costs, and conserves plant capacity for future expansion needs. This reduced infiltration plus Transite's high flow capacity (Manning's N=.010) often permits the use of smaller diameter pipe for new installations.

For further information on how this Ring-Tite Joint, used with corrosion resistant asbestos-cement Transite Pipe can help reduce your sewage costs, write Johns-Manville, Box 60, New York 16, N. Y. Ask for folder TR-103A.

## Why the RING-TITE JOINT cuts your sewage costs



**Two rubber rings** and Transite Sleeve (cutaway) can be assembled quickly over Transite Pipe ends to make a pressure-tight joint. These flexible joints effectively absorb vibration, help compensate for soil movements.

### *TIGHT ALL THE WAY*

**Johns-Manville Transite Building Sewer Pipe assures a tight sewer system throughout.** Many municipal officials are insisting that house and building connections to their sewage lines be made with Johns-Manville Building Sewer Pipe to assure tightness throughout their systems. This pipe also has the rubber ring sealed joint that is shown above.

**Johns-Manville TRANSITE SEWER PIPE**

# ACT NOW!

**rehabilitate your water system and give it new life with . . .**

# IOWA

## MECHANICAL JOINT CUTTING-IN VALVES AND SLEEVES

*Replace those "tired," worn-out valves . . . be prepared for all emergencies!*

**Now, more than ever, it's vital to keep your customers supplied with water and fire protection at all times . . . Replace worn-out valves and add needed valves with IOWA Mechanical Joint Cutting-In Valves and Sleeves . . . It's the fastest, simplest and most economical method of cutting gate valves into existing water lines . . . Furnished complete with joint accessories . . . No lead, no jute, no caulking . . . Just a ratchet wrench . . . Ideal as auxiliary valves for fire hydrants . . . Simplifies hydrant inspection and maintenance . . . Act now before it's too late . . . Write today for descriptive literature!**

**KEEP WORK CREWS BUSY ON JOBS LIKE THIS . . . IT PAYS!**

**IOWA VALVE COMPANY**

**201-299 N. Talman Ave., Chicago 80, Ill.** • *A Subsidiary of James B. Clow & Sons*

CARLON PLASTIC PIPE BREAKS INSTALLATION TIME RECORDS
CARLON PIPE NOW USED FOR WATER SERVICE LINES
New CARLON Lightweight Plastic Pipe is Easier to Install and Lasts Longer
CARLON ACCLAIMED NEW PIPING ACHIEVEMENT
Stresses Need of Low-Cost Public Housing
CARLON GUARANTEED AGAINST ROT, RUST AND ELECTROLYTIC ACTION

# GUARANTEED FOREVER...

## . . . AGAINST ROT, RUST AND ELECTROLYTIC CORROSION!

**CARLON** plastic pipe is impervious to the enemies of metallic pipe . . . lasts far longer without maintenance. **CARLON** has the best flow characteristics of any pipe available today, and because it will never accumulate scale or sediment, flow rate remains constant for the life of the pipe.

**CARLON** is lightweight (only ⅛th as heavy as steel) . . . one man can install it without rigging equipment or special tools. This flexible pipe is supplied in long lengths (up to 400 feet) which follow irregular ditch lines and uneven ground surfaces. Because of these long lengths and flexibility, **CARLON** can be installed with far fewer fittings than rigid metal pipe.

Absolutely leak-proof joints can be made quickly with **CARLON** plastic pipe fittings. Flexible **CARLON** absorbs vibration stresses without developing leaks at the couplings. Install it and forget it!

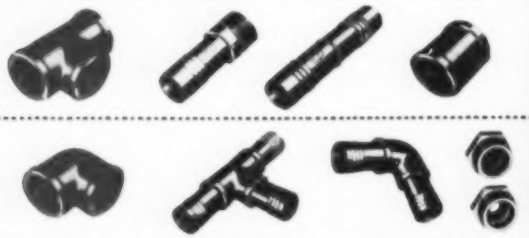
*WRITE TODAY FOR CATALOGS.*

1014-CP

Every foot of **CARLON** is factory-tested at greater-than-working pressures for more than 8 hours.

CARLON CP

*Buy the Pipe with the Stripe!*



**CARLON PRODUCTS CORPORATION**

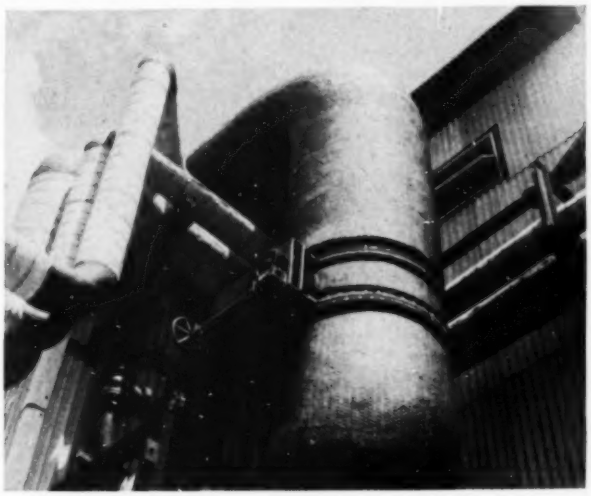
*Pioneers in Plastic Pipe*

**CANADA: Micro Plastics, Ltd., Acton, Ontario • EXPORT: H. E. Botzow, New York City**

**10300 MEECH AVENUE • CLEVELAND 5, OHIO**

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



# R-S VALVES
## OPERATE EASILY
## *Above or Below Floor Level*

Because of their comparative light weight and minimum space requirements, R-S Valves are particularly well adapted for installation at considerable heights above the floor level. In such positions they are usually operated manually by chainlever, chainwheel, extended reach rod or controlled automatically.

Where the valve must be installed in an inaccessible position below the floor level, a floor stand is provided. Control is just as quick and uniform as in those installations where the handwheel is mounted directly on the valve shaft.

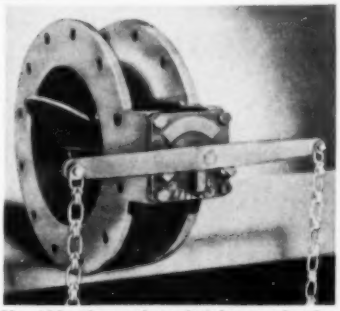
Simplicity of design, the wide range of application and ease of operation indicate the high order of metallurgical and mechanical engineering that is embodied in every R-S Valve.

*Consult your local R-S Valve Engineers, or write direct.*

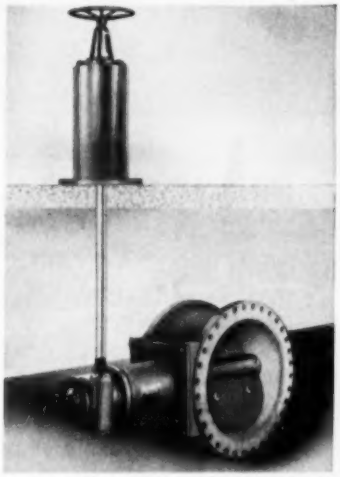
**R-S PRODUCTS CORPORATION**
**4600 Germantown Avenue, Philadelphia 44, Pa.**

*An S. Morgan Smith Company Subsidiary*

**DISTRICT OFFICES IN PRINCIPAL CITIES**



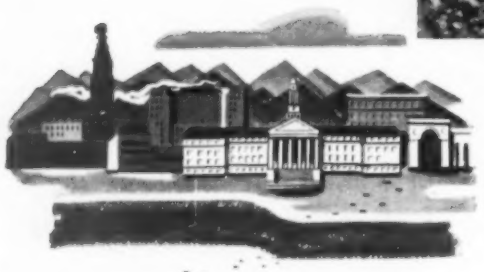
**No. 688—Heavy duty chainlever valve for quick opening or closing in elevated and inaccessible locations. R-S Valves are used to control and shut-off the volume and pressure of nearly all materials in the temperature range from minus 300° to plus 2000° F. 2 to 2500 psig.**



**No. 788—Heavy duty valve equipped with rubber seat, totally enclosed gear reduction drive, extended shaft and floor stand. Positive shut-off is obtained up to 125 psig with rubber seated valves and commercially tight shut-off to even higher pressures with a babbitted seat.**

**No. 839—8-inch heavy duty valve equipped with 125-pound flanges, 18-8 shafts, bronze bushings and a throttling type motor operator for the control of low pressure air.**

# Denver Prefers Concrete Pressure Pipe



Thirty-two years ago the city of Denver installed its first concrete pressure pipe. From time to time, as the demands for water increased, Denver has added to its water transmission system . . . and the pipe selected most has been concrete pressure pipe.

Denver engineers give these reasons for this preference: (1) the permanent high carrying capacity of concrete pipe, (2) the immunity to blow-out or rupture, (3) proof against tuberculation, corrosion, and electrolytic damage, (4) extremely long life and maintenance economy.

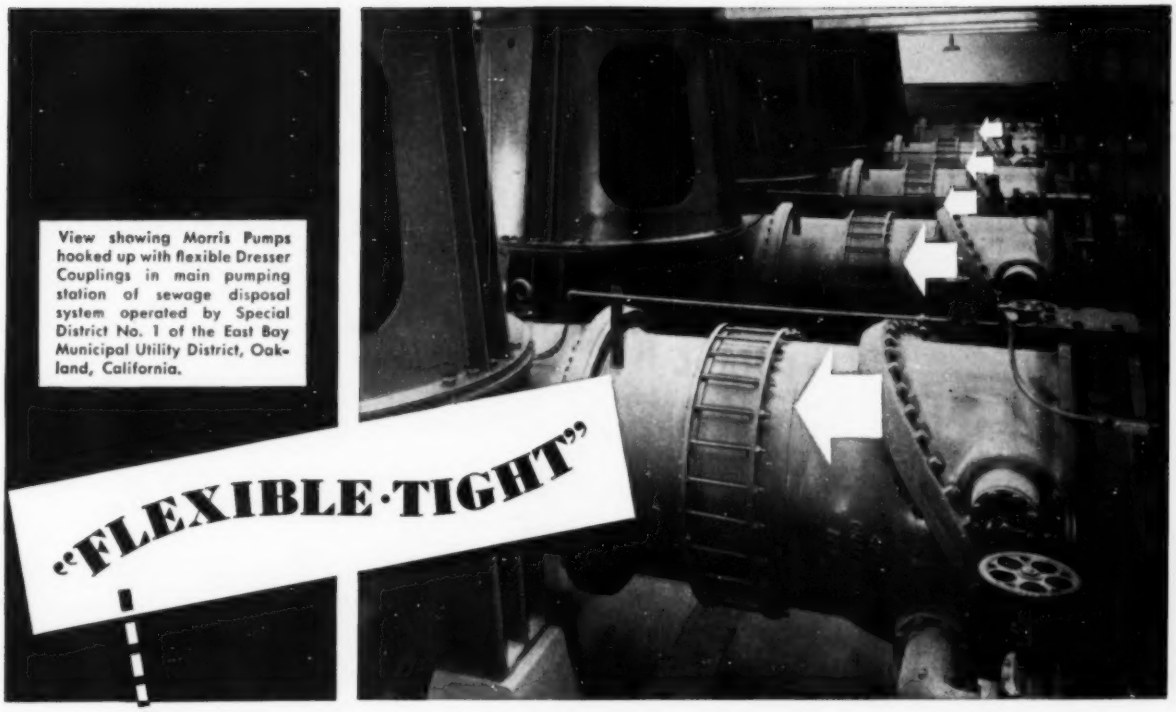
The performance in Denver and in other cities, both large and small, throughout the country proves the distinct advantages offered by concrete pressure pipe. Let us show you how these same advantages can be used for the water system in your community.

**Engineering Assistance** . . . our staff of trained engineers will be happy to help you with any water storage or transmission problem. This service is offered you at no obligation. Write Mr. H. F. Peckworth, Managing Director, American Concrete Pressure Pipe Association.

*Water for Generations to come*

**Concrete PRESSURE Pipe**

**AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION**
228 North LaSalle Street
Chicago 1, Illinois



View showing Morris Pumps hooked up with flexible Dresser Couplings in main pumping station of sewage disposal system operated by Special District No. 1 of the East Bay Municipal Utility District, Oakland, California.

"FLEXIBLE-TIGHT"

# These are profitable connections

Leading pump manufacturers such as the Morris Machine Works welcome Dresser Couplings in their pump installations because these "Flexible-Tight" joints offer four important advantages:

The Dresser Coupling compensates for any slight misalignment of the piping, permitting much simpler and quicker installation.

The coupling is a "must" for dismantling purposes. It permits easy removal and reinstallation of the spool piece.

The Dresser Coupling permits a flush internal pipe connection with minimum turbulence or eddying.

Perhaps one of the most important functions of the Dresser Coupling is to remove entirely any piping strains on the pump casing, avoiding danger of destroying the alignment of the pump.

All these advantages stem from the fact that Dresser Couplings are designed to provide a "Flexible-Tight" joint that's easy to install. Resilient, long-lived gaskets harmlessly absorb stresses and strains, protecting pipe and equipment. Proved in use for more than 60 years.

Write today for more information about Dresser applications on water, sewage, and industrial waste projects.

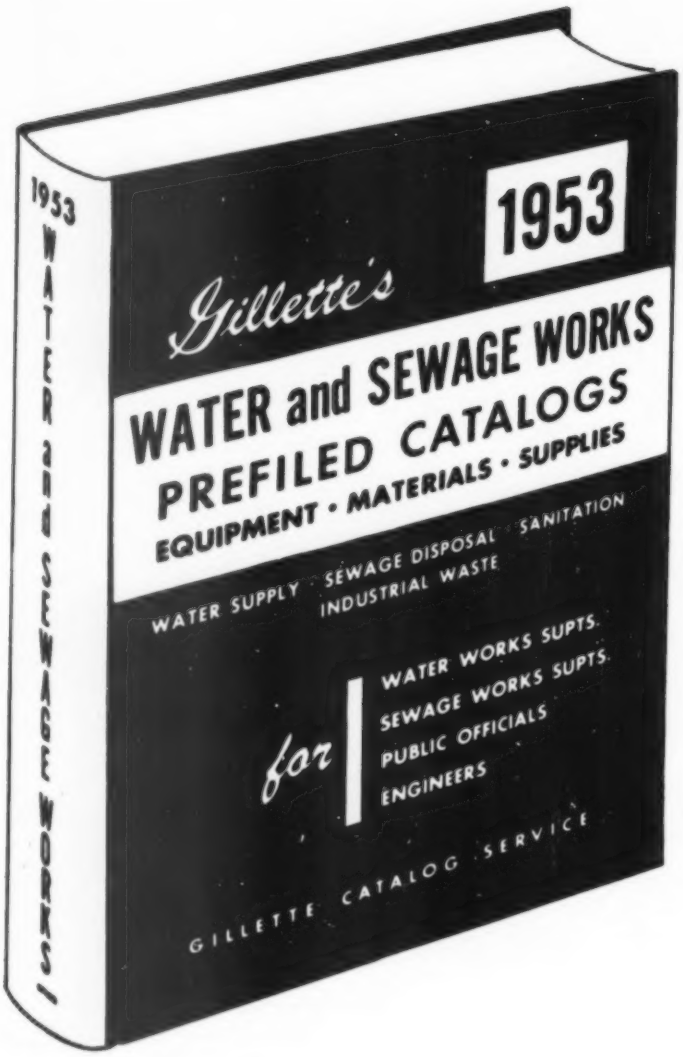
These 67" air mains of the Sanitary District Sewage Works, Chicago, are Dresser-Coupled to provide complete dependability. Leaks could not be tolerated. A fraction of a pound saved in air pressure meant dollars saved in electric power costs. Dressers were selected to assure that saving.

DRESSER®

"FLEXIBLE-TIGHT"

COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto, Ont.




# *Coming A Permanent Catalog For*

**THIS WILL BE**

## Your most useful Source of Buying Information

***Keep it handy***
***Use it often***

**FOR BUYERS OF**

EQUIPMENT, MATERIALS AND SUPPLIES FOR

## Water Supply
## Sewage Disposal
## Industrial Waste

*"BOILED DOWN" TO SAVE YOU TIME AND ENERGY!*

- **This book will save you cabinet and floor space and the secretarial time that would otherwise be spent in classifying and filing individual manufacturers' catalogs.**
- **It saves you, too, the time and trouble of writing to manufacturers for the information you need. Here are enough facts to enable you to study the product that interests you and to decide whether to call your local dealer or distributor for decisive action.**
- **When you want information quickly, on a certain class of products or on the product of a specific manufacturer, turn first to the index for the name or trade name of the product in which you are interested and then to the manufacturers' catalogs which are arranged in alphabetical order by manufacturers' names.**
- **Send in your coupon. It will be filed and Catalog sent as soon as available. Do not ask for acknowledgment as hundreds of requests are being received.**

# *your office... use it often*

**To be assured of getting** *Gillette's* **WATER & SEWAGE WORKS PREFILED CATALOG**
**fill in and return coupon**

Get the prefiled catalog habit and conserve your time, temper and energy. You and your office associates will put this book to constant use. Here in this one volume you will be able to find whatever type of equipment or material you may need. You will have the information as to the product itself, and right with it the name and address of manufacturer or his sales agent.

By the use of this Catalog you will be able to compare the products of one manufacturer with that of another, and in this way decide which is best suited for your immediate needs. Individual manufacturers' Catalogs have a way of getting lost in the files, this causes loss of time and temper. In Gillette's Water & Sewage Works Prefiled Catalog you will have all the information in one hard cover, well-bound, well indexed book. Put your name on record now for your copy.

**GILLETTE'S WATER AND SEWAGE WORKS PREFILED CATALOG FILE • 22 W. MAPLE ST., • CHICAGO 10**

## HELP US TO HELP YOU

**You are the men who manage and operate waterworks, sewage and industrial waste treatment plants—Your title may be Consulting Engineer, Superintendent, Manager, Operator or one of several others; you may be a Chemist, a Sanitary Engineer, or an engineer of Design, Construction or Maintenance of utlity plant. Whatever your particular sphere of work there are certain supplies or equipment that you have need for. List on the coupon the type of supplies or equipment on which you would like to have information always at hand.**

**Gillette's WATER AND SEWAGE WORKS PREFILED CATALOG**
**22 West Maple Street, Chicago 10, Illinois**

Gentlemen:

☐ I would like to receive a Copy of the 1953 edition

In this edition I would like to see the catalogs of the following manufacturers:

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My Name..... My Title.....

My Company or Department Name.....

Street Address.....

City..... Zone..... State.....

# SCREENS: EASILY FABRICATED OF EVERDUR FOR EXTRA CORROSION RESISTANCE

Fabricated of Everdur* Copper-Silicon Alloys, this sewage screen offers years of protection against corrosion at all stages of sewage treatment. Everdur alloys are the standard for equipment where high corrosion resistance must be incorporated into readily fabricated, lightweight structures.

Everdur applications include gates, guides and bolts, valve and gate stems, weirs, float chambers, troughs, manhole steps and electrical conduit. These highly corrosion-resistant alloys are characterized by great strength and excellent working properties. Depending on which alloy is used, Everdur may be worked hot or cold, welded, machined, forged or cast and is available in plates, sheets, rods, tubes, electrical conduit and casting ingots.

If you would like detailed information for specific applications or designs, the services of our Technical Department are always available to you. Our Publication E-11 describes Everdur Alloys and applications in detail. Write for it. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

*Reg. U. S. Pat. Off. 5113S

**EVERDUR**

**ANACONDA®**

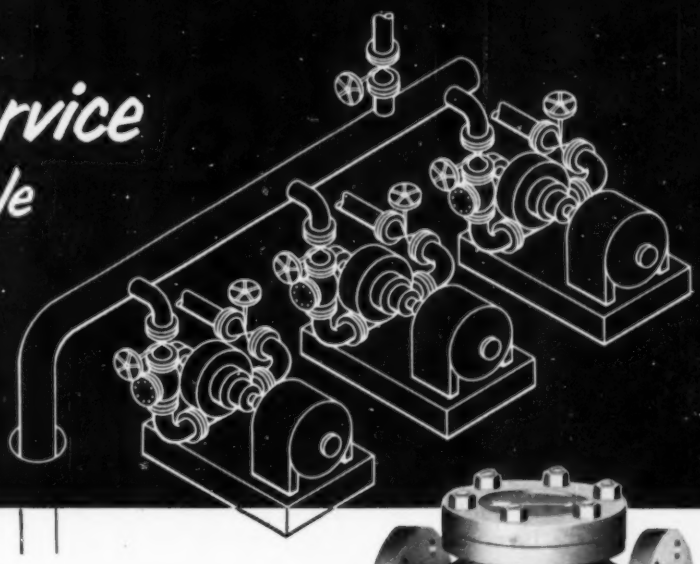
**COPPER-SILICON ALLOYS**

STRONG • WELDABLE • WORKABLE
CORROSION-RESISTANT

# It's not what you Pay for Valves . . . it's what they Cost you

## on Water Service for example

(A Case History)

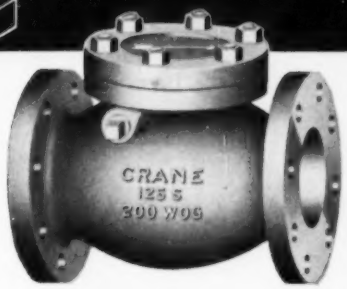


What you pay for valves is not the final criterion of value. Not when maintenance costs can quickly equal or exceed purchase price. And a valve that threatens production is no bargain at any price . . . no attraction to a thrifty buyer.

Take this case in a large eastern paper mill. A single bank of water pumps supplied the entire mill. Leaky check valves at these pumps were a constant problem. Regularly, the checks needed replacement, only to be found leaking between pumping cycles a few months later.

A change-over to Crane Quality Check Valves put a complete stop to this costly maintenance and threat to production. Installed well over a year, Crane checks are protecting the mill against loss of water pressure at no added cost.

Today, more than ever, you need greater assurance of quality in piping materials. You get it in Crane Valves—the recognized standard of quality with thrifty buyers in every industry. Your big Crane Catalog offers complete selections for all needs; your Crane Representative is always at your service.




**Crane Check Valves are made in all types, in brass, iron, steel, and alloys. See your Crane Catalog.**

# CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
*Branches and Wholesalers Serving All Industrial Areas.*

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

# more efficient than more economical than ever.....

**What? A still better cast iron pipe? Better than that which has served with unrivalled efficiency, economy and long life all over the world?**

**Yes, and beyond doubt! Modernized cast iron pressure pipe—with bell-and-spigot or mechanical joints—centrifugally cast and centrifugally cement-lined—is not only the most efficient and economical, but the most advanced pipe ever made for water distribution.**

**The centrifugal casting process—the most modern of all methods of producing cast iron pressure pipe—has been adopted by all members of the Cast Iron Pipe Research Association.**

* * *

**The same basic metal which has proved its ability to function for more than a century in water supply and distribution mains, is still used. By research in metallurgy and the centrifugal casting process, cast iron pipe has been modernized and made tougher, stronger and more uniform in quality.**

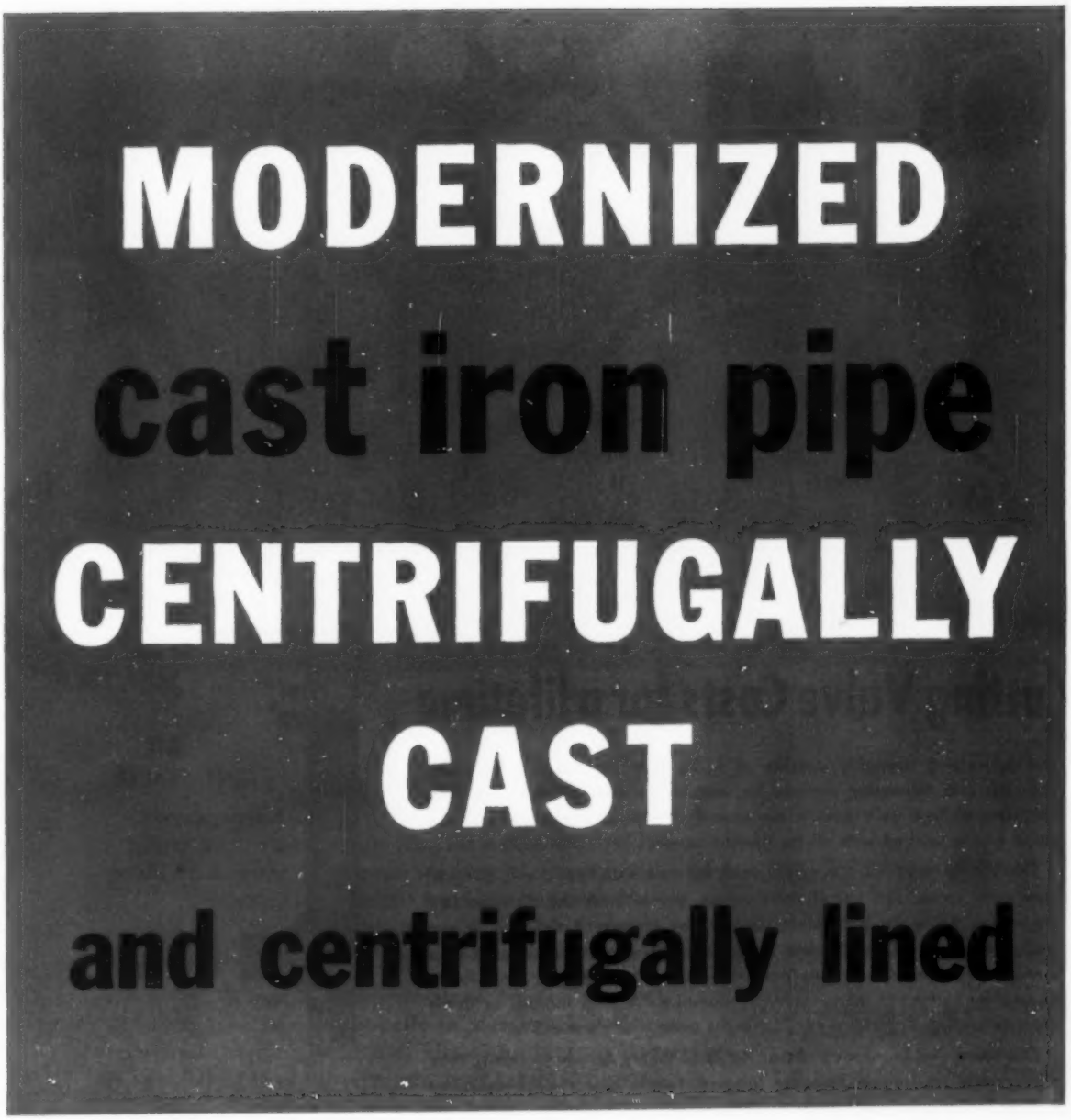
**Cast iron pipe is available with *cement mortar lining, centrifugally applied.* This is *modernized* cast iron pipe—with *sustained carrying capacity* for the life of the pipe. Since it is tuberculation-proof it has greatly reduced friction-loss with resultant reduction in pumping costs.**

**If you want pipe at its finest—at its highest efficiency and offering its maximum economy—your new mains will be laid with centrifugally-cast, centrifugally-lined, cast iron pipe. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.**

CAST IRON ®

## *Modernized* cast iron

# ever—

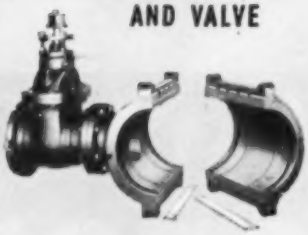



# pipe

*for Modern Waterworks Operation*

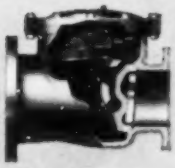
SQUARE BOTTOM VALVE

DOUBLE DISK VALVE

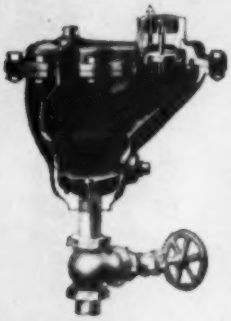


TAPPING SLEEVE AND VALVE

MOTOR OPERATED VALVE



CHECK VALVE



AIR VALVE

FIRE HYDRANT

# Cutting Valve Costs for a lifetime

This interesting assembly consists of a 20 inch Rensselaer valve with reducing and increasing sections for installation in a 30 inch pipe line. The integral type gear case is designed for the working pressure of the valve and is packed with oil for lifetime service.

There is no need for a concrete vault for valves equipped with integral type gear cases. Just install valve boxes, shovel back the dirt and forget it, for this is the Rensselaer double disc valve with the well known wedge action. On closing, when the gates reach a position opposite their seats, the powerful wedging action presses them squarely and firmly against their seats. It is impossible to damage the stem threads or throw the stem out of alignment, and the gates open and close easily.

The valve you buy today should serve faithfully for many years. Why not provide maximum insurance against future maintenance costs by putting in Rensselaer valves in the first place?

101

**Rensselaer VALVE COMPANY, TROY, N. Y.**

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES • CHECK VALVES • AIR RELEASE VALVES

**A SUBSIDIARY OF NEPTUNE METER COMPANY**

***Sales representatives in principal cities***

*Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A.N.A.*

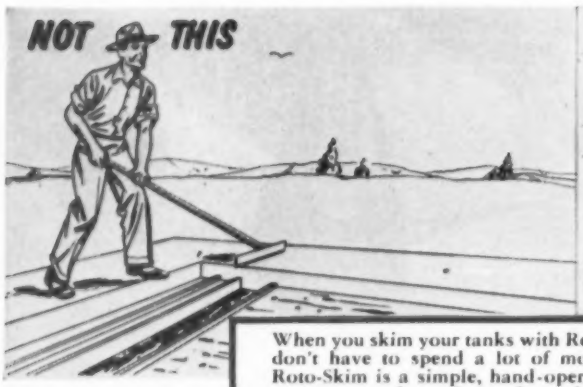
**THIS RURAL SCENE** is not an unusual background for cast iron pipe. The installation might be a water supply line for a city nearby. It could be a sewer force main leading to a treatment plant. Also it might be a gas transmission line for a city, in which case it would unquestionably be of the mechanical joint type.

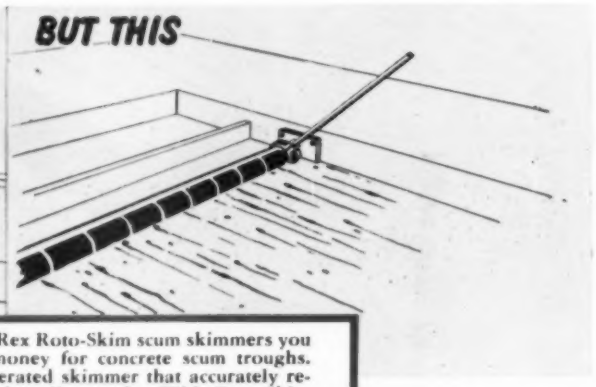
U. S. cast iron pipe in sizes 2-inch through 24-inch are cast centrifugally in metal molds with bell-and-spigot; mechanical joints and plain ends. All sizes of flexible joint and integral flange pipe and all pipe 30-inch and larger are cast by the pit cast process. By whichever process the pipe is made, high quality is assured with the modern control methods employed during its manufacture.

**United States Pipe and Foundry Co.,**
**General Offices, Burlington, N. J.**
**Plants and Sales Offices Throughout the U. S. A.**

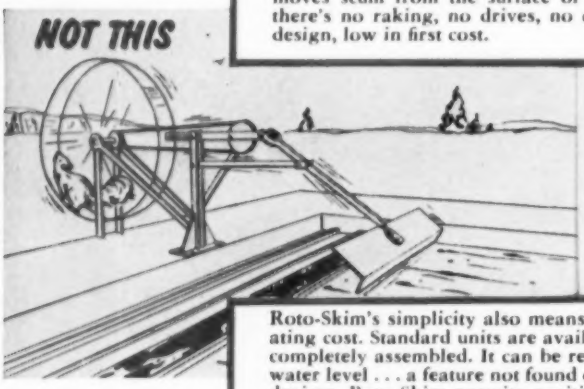
**U.S.**
**cast iron**
**PIPE**
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

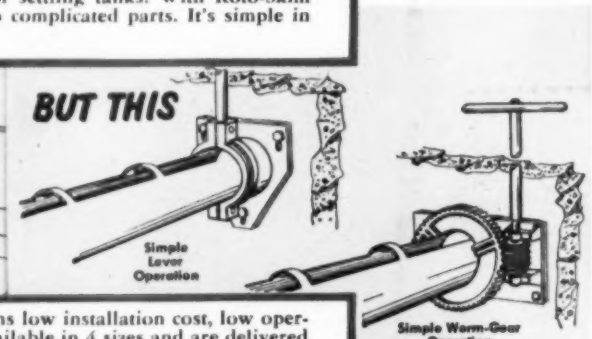
# WHEN YOU SKIM WITH REX ROTO-SKIM



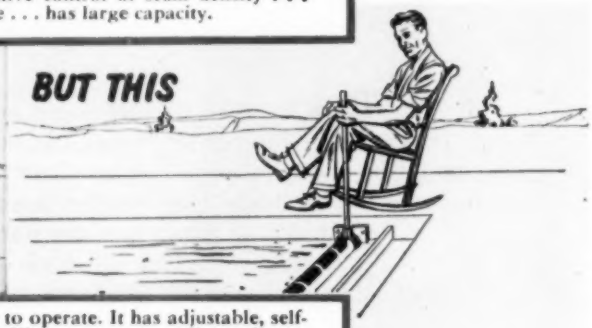




When you skim your tanks with Rex Roto-Skim scum skimmers you don't have to spend a lot of money for concrete scum troughs. Roto-Skim is a simple, hand-operated skimmer that accurately removes scum from the surface of settling tanks. With Roto-Skim there's no raking, no drives, no complicated parts. It's simple in design, low in first cost.




Roto-Skim's simplicity also means low installation cost, low operating cost. Standard units are available in 4 sizes and are delivered completely assembled. It can be readily adjusted for fluctuations in water level . . . a feature not found on so-called automatic skimming devices. Roto-Skim permits positive control of scum density . . . requires minimum operating time . . . has large capacity.




Rex Roto-Skim is extremely easy to operate. It has adjustable, self-aligning end supports. Plywood fillers overcome wall roughness. Both types are fitted with renewable, grease resisting, synthetic rubber seals with spring steel inserts which are completely watertight, yet permit free rotation of the pipe. No power is required. No greasing is necessary. There's no stuffing box seal.

For complete details, call your nearest Rex Sanitation engineer or write for Bulletin 51-83, Chain Belt Company, 4610 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT REX COMPANY ®

**Chain Belt COMPANY of Milwaukee**

Atlanta • Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Dallas
Denver • Detroit • El Paso • Houston • Indianapolis • Jacksonville • Kansas City • Los Angeles
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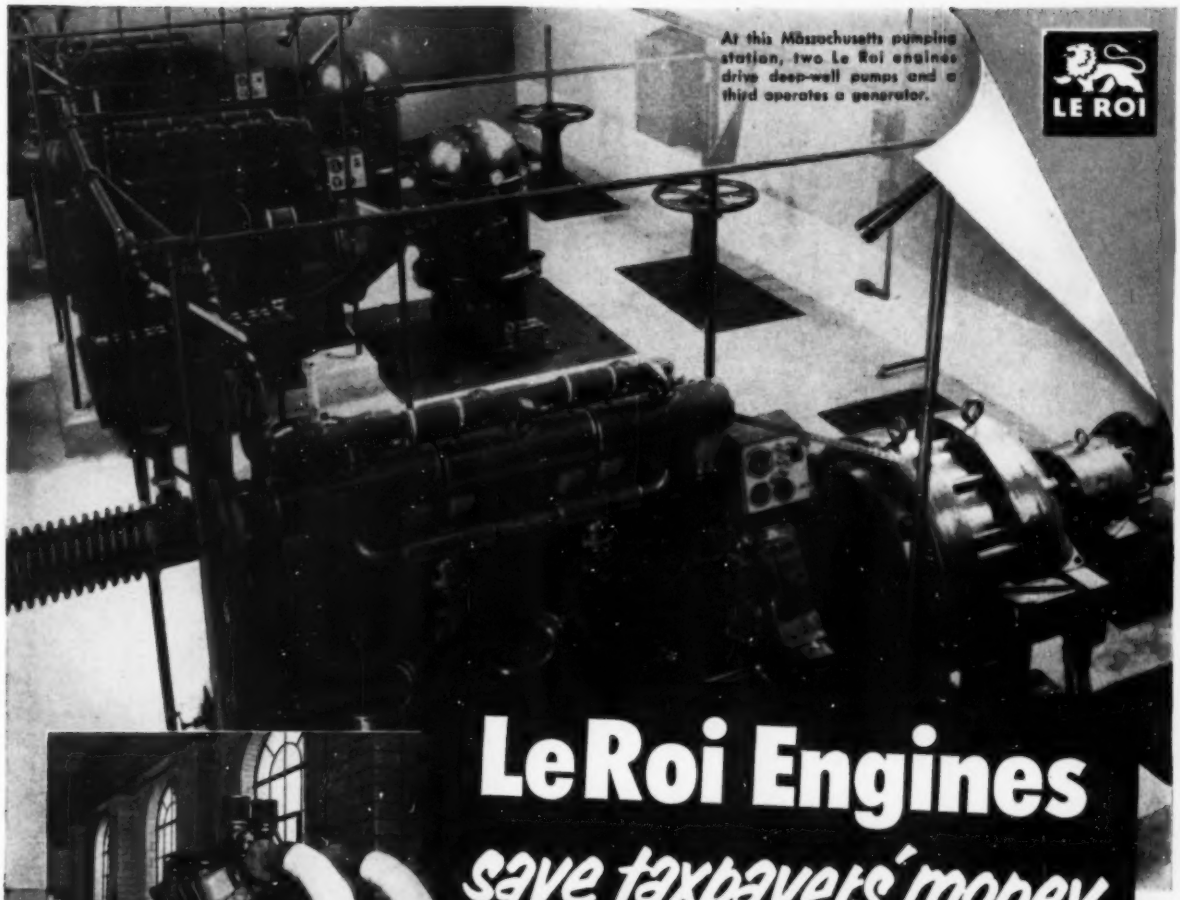
Portland, Ore. • Springfield, Mass. • St. Louis • Salt Lake City • San Francisco • Seattle • Tulsa • Worcester

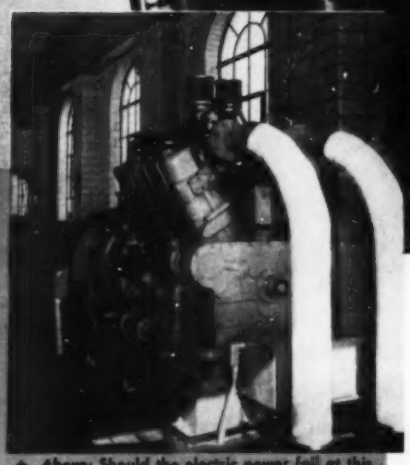
*Export Offices:* Milwaukee and 19 Rector St., New York City



At this Massachusetts pumping station, two Le Roi engines drive deep-well pumps and a third operates a generator.

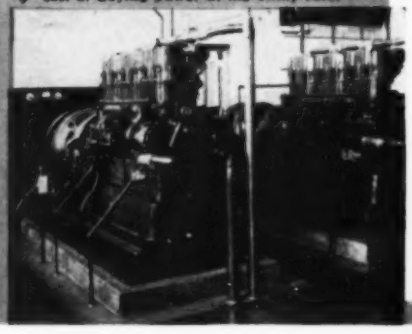
LE ROI

# LeRoi Engines *save taxpayers' money*



▲ *Above:* Should the electric power fail at this Mississippi Lock and Dam, the Le Roi standby unit automatically swings into action — opening and closing locks or operating de-icers with consistent dependability.

*Below:* These two Le Roi engine-generator units operate on "no-cost" sewage gas, to produce electric power at a fraction of the cost of buying power at the utility rate. ▼



HERE are a few examples that prove you can cut operating costs by using Le Roi engines — for pumping, for generating electricity, for standby service.

A city in Wisconsin has two Le Roi generating units operating on sewage gas. These units have saved the taxpayers nearly $4000.00 a year for the past 14 years.

A town in Oklahoma cut pumping costs over 50% with a Le Roi engine operating on natural gas. Taxpayer savings — $7600.00 in the first 10 months of operation.

New York City uses 3 Le Roi 600 hp engines to provide 21,000 gpm standby capacity for its 179th Street pumping station. Here dependability is the prime factor.

Use dependable, low-cost Le Roi power and lighten the tax load in your community. Le Roi engines are available in sizes ranging from 20 to 600 hp — custom generator sets in sizes from 50 to 300 KW. They operate on no-cost sewage gas, natural gas, butane, or gasoline. Write today for detailed information.

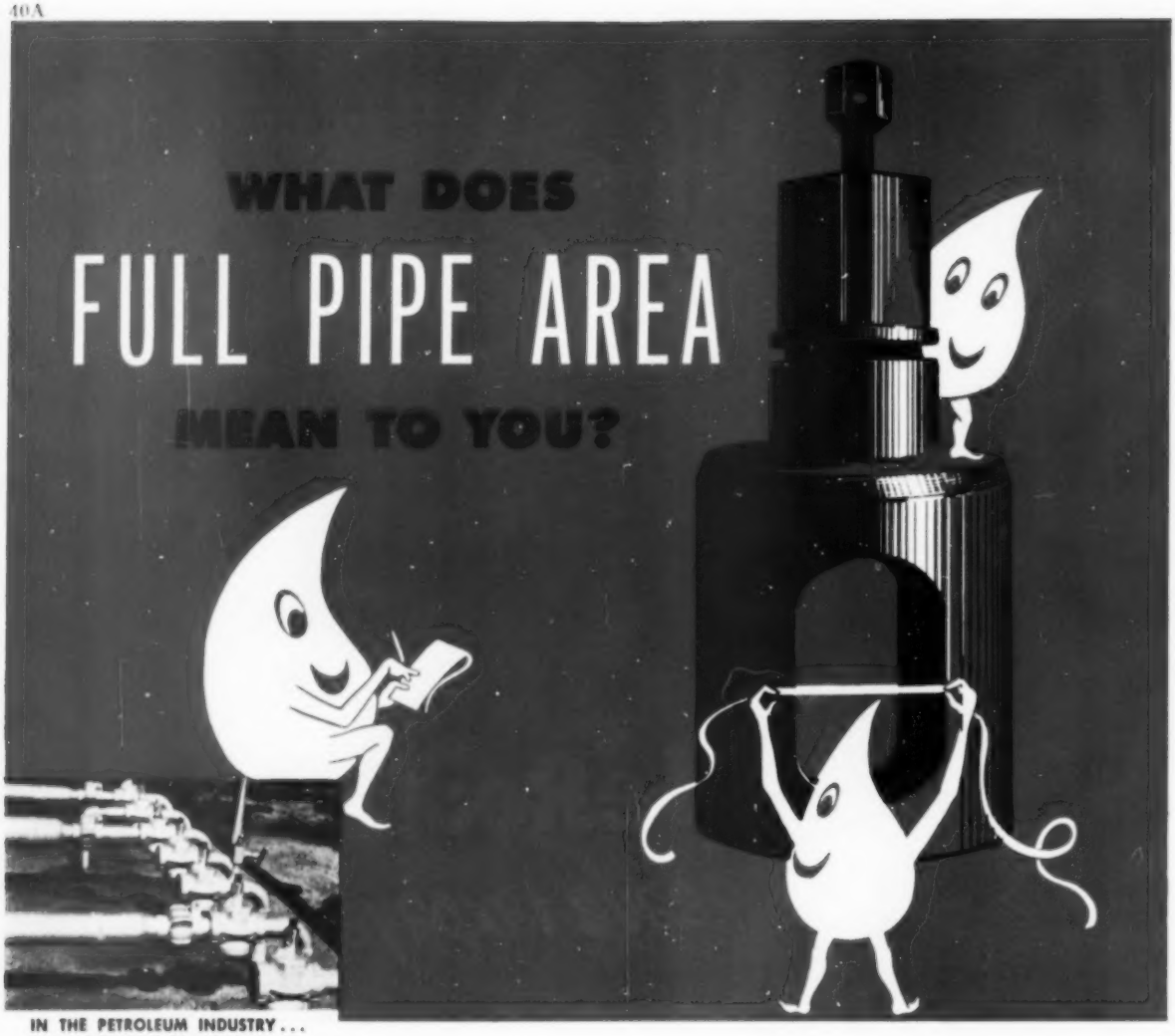
**LE ROI COMPANY**

Dept. WA-4, 1706 S. 68th Street • Milwaukee 14, Wisconsin

*Plants:* MILWAUKEE • CLEVELAND • GREENWICH, OHIO

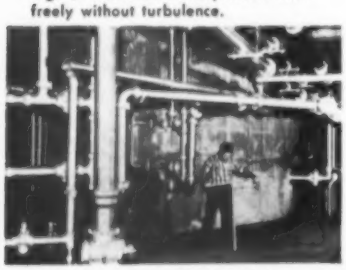
E-81

# WHAT DOES FULL PIPE AREA MEAN TO YOU?



**IN THE PETROLEUM INDUSTRY . . .** a.c.f. Cylindrical Plug Valves give full flow, quick quarter-turn shut-off.

**ON CHEMICALS** viscous heavy ladings or materials in suspension flow freely without turbulence.



**IN SEWAGE PLANTS** a.c.f. Cylindrical Plug Valves handle raw sewage with ease—plug shears obstructions.

**It means, primarily, a smooth, straight-through flow. Look through an a.c.f. CYLINDRICAL Plug Valve, and you'll see why solids in suspension and heavy, viscous ladings pass so easily. There are no restrictions to retard flow! The valve port has an area at least as large as the pipe itself. For the lowest head loss of *any* plug valve in the world, specify a.c.f. CYLINDRICAL, Lubricated Plug Valves. You'll save time and pumping cost!**

a.c.f. CYLINDRICAL FULL PIPE AREA PLUG VALVES

Write for Catalogue 4-WS, American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities

IN WATER AND SEWAGE PROJECTS

# There's more to CORROSION than meets the eye

## Sometimes VISIBLE... Often HIDDEN... Corrosion Strikes Every Installation

This year, the nation's water and sewage works will pay millions of dollars for needless losses created by corrosion... *yet much of this corrosion may never be discovered* until it's too late to protect—and time to pay!

Corrosion is readily detected as rust layers or failing paint on exposed surfaces. But, by far, the major costs of corrosion come from hidden areas—where only minute inspections and constant care can prevent costly failures.

### YOU LOSE IN A "WAITING GAME"

Don't wait for rust or other visible signs to appear. Visible or hidden, corrosion will destroy costly equipment... increase maintenance costs... and contaminate vital water supplies, thereby creating needless wastes that will cost you thousands of dollars.

### YOU CAN PREVENT NEEDLESS WASTE

Check now for corrosion's presence. Double-check areas that may be vulnerable to *hidden corrosion*. If you would like help, an AMERCOAT Field Engineer will gladly assist you in making a thorough analysis. There is no obligation.

### What is AMERCOAT?

AMERCOAT is a method of corrosion control. Not just a single product, but a complete LINE of coatings, individually formulated to solve or control specific industrial corrosion problems.

FOLLOW THE LINE OF [illegible] RESISTANCE... PROTECT WITH *Amercoat!*

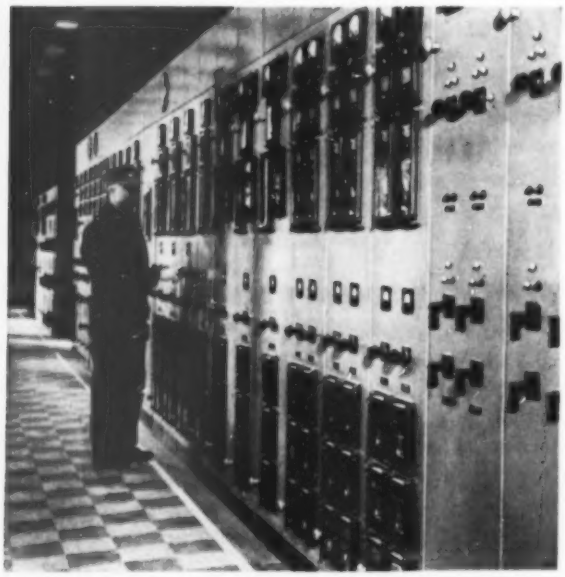
**AMERCOAT CORPORATION**

4809 FIRESTONE BLVD., SOUTH GATE, CALIFORNIA

CHICAGO, ILL. NEWARK, N. J. JACKSONVILLE, FLA. DALLAS, TEX.

**1. SAN FRANCISCO.** Main control room at North Point treatment plant represents a modern trend in plant design. Completely G-E equipped, this room houses line-up of main plant switchgear and limitamp control. M. & K. Corp., Stolte, Inc., Fred J. Early, Inc., and Hass & Rothschild acted jointly as general contractors for the plant. Electrical contractors were Pacific Electrical and Mechanical Co., Inc. and Del Monte Electric Co.

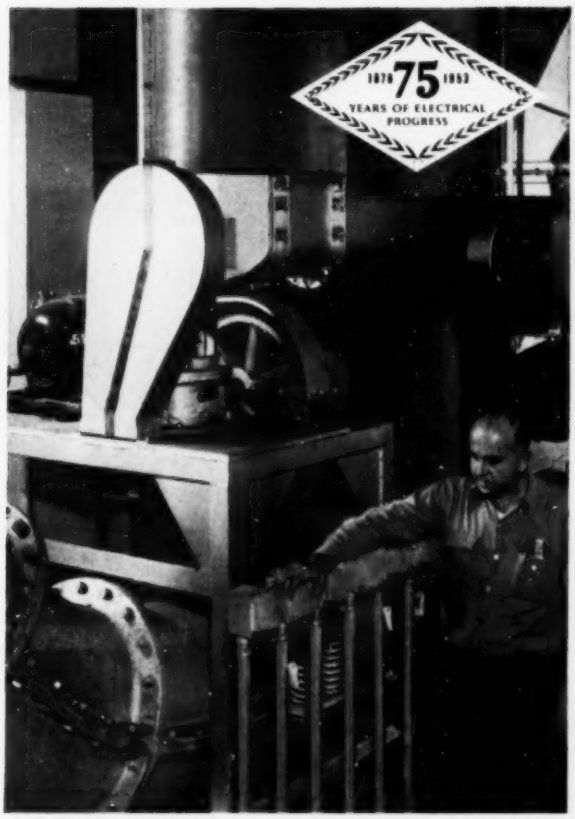
# CLEAN WATERS programs



**3. NEW YORK.** G-E switchgear at Owls Head provides primary control and protection for motors, transformers. Plant generates most of its power from sludge-digester gas.

In main pump room at Owls Head plant, six G-E motors ranging from 450 to 700 hp drive Worthington pumps. Plymouth Electric Construction Co. was electrical contractor.

**2. LOS ANGELES.** All motors at Hyperion plant were selected by G-E engineers to fit the application. A plant foreman starts a G-E 250-hp motor that drives a vapor fan.




G-E Tri-Clad* gear-motors provide power for intricate sludge conveyor system shown here. Motor design provides protection from physical damage, operational wear and tear.

# pay off for three cities

## G-E equipment plays major role in new sewage treatment plants, helps make pollution control programs successful

Three cities—Los Angeles, San Francisco and New York—are typical of many others that are taking action to eliminate pollution problems resulting from increased population and industrial growth.

Hyperion Sewage Treatment Plant near El Segundo, California, will serve the entire Los Angeles area by helping to restore healthful bathing beaches. San Francisco's North Point Treatment Plant—a unit in a planned 21-plant system—will help clean bay area waters; and Owls Head Treatment Plant, in New York, is designed to serve the area's present population of one million plus eventual increase of 20 percent. Each installation makes possible improvement of fishing and recreational facilities.

General Electric equipment makes up a large part of the electrical system for each plant. G-E application engineers worked closely with city engineers, architects and contractors to help design electrical systems tailored to the requirements of each plant.

Specialists in sewage-plant electrification, G-E engineers will apply their experience in working with your engineers or consultants, too. Contact your G-E Apparatus Sales Representative early in the planning stage. Ask him now how you can put G.E.'s CLEAN WATERS program to work in your community. General Electric Co., Schenectady 5, N. Y. 666-76

*Registered trade-mark for General Electric Co.

**Engineered Electrical Systems for Sewage Plants**

**GENERAL ELECTRIC**

# What's in a name?

**"What's in a name? That which we call a rose**
**By any other name would smell as sweet."**

*Romeo and Juliet. Act II, Sc. I.*

**What's in a name? We like to feel that there is a lot in the name "Welsbach". That after 75 years it stands for integrity . . . for fair dealing . . . for quality in service and product . . . and for true dependability. What's more we believe that the people we do business with feel that way about "Welsbach".**

**In the municipal field, Welsbach offers an unmatched quality of service to those municipalities where Welsbach's wide-spread abilities are used. In construction, in water purification, in street lighting, in water service bronze and in airport lighting . . . in each of these, the name "Welsbach" stands for Quality . . . for Service . . . and for Dependability. That's the answer to the query "What's in a name?"**

**CONSTRUCTION DIVISION**
Construction . . . especially of water treatment and sewage treatment plants, electric systems, sub-stations, etc.

**OZONE PROCESSES DIVISION**
Water purification . . . outstanding results in the removal of taste and odor. Destruction of phenols and cyanides in industrial wastes.

**AIRPORT LIGHTING DIVISION**
Airport runway lighting systems for safety under restricted visibility conditions.

**KITSON DIVISION**
Valves and fittings—water and gas service bronze—Corporation Tapping Machines.

**STREET LIGHTING DIVISION**
Installation, maintenance and repair of gas and electric street light and traffic light systems.

*for municipal service . . .*

**THE WELSBACH CORPORATION**
**DESIGNERS • MANUFACTURERS • CONSTRUCTORS**
**1500 Walnut Street • Philadelphia 2, Pa.**

# Rarin' to go

**to Grand Rapids**

**and the AWWA Convention**

**May 10-15**

***Stop in and see us . . . Booths 31-32***

**R. D. WOOD COMPANY**

**Public Ledger Building, Independence Square**
**Philadelphia 5, Pa.**

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

150th anniversary

WET TRENCHES *Can't Slow Up . . .*

# *Tylox* jointed PIPE JOBS

WHEN you specify TYLOX flexible rubber pipe jointing gaskets, you are assured of a line that's built faster because construction men lose no time worrying with mud or water in the trench. *Flexible* TYLOX seals mechanically, and compensates for angularities in the line. Neither *immediate* backfill, nor the presence of mud and water during jointing can affect this seal. The work *keeps* moving and your project finishes on or ahead of schedule, and — it's a leakproof job . . .

Unlike mortar or bituminous jointing materials, TYLOX does not depend upon adhesion to form a seal. TYLOX gaskets "pack" into the joint's annular space under *compression,* as the pipe is shoved home. It can never shrink away or crumble, leaving crevices for the entrance of ground water or roots.

And this compression seal lasts the life of the pipe line, because TYLOX is made of a rubber compound that *stays* flexible and doesn't deteriorate. Under ground, and under compression, TYLOX is virtually ageless.

On your next pipe project calling for tongue-and-groove or bell-and-spigot pipe, specify TYLOX jointing gaskets to speed construction and make the line "leakproof for life."

*Write today for complete specification data and literature on TYLOX Pipe Jointing Gaskets.*

TYLOX RUBBER GASKETS

Cement tongue and snap on TYLOX gasket.

Lubricate sliding surfaces with TYLOX cement.

Shove the pipe home to line and grade.

1772

**HAMILTON-KENT**

"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"

# CHICAGO LEARNED FROM EXPERIENCE

## that only C-P-P* meets the BIG 3 REQUIREMENTS

The Chicago area's first Prestressed Concrete water supply line was installed in 1939. They've watched its performance carefully ever since.

That's why Price Prestressed Pipe was picked for two recent lines in the Chicago area . . . one 2,700 ft. line of 30" pipe and one 37,000 ft. line of 24". They wanted *long life, sustained high carrying capacity and great structural strength*—the "Big 3" requirements of water lines . . . and only concrete could do the job.

1. *Long life.* With Price Prestressed Pipe, only *concrete* is exposed. When buried in the ground, concrete is ageless as limestone . . . life is measured in centuries.

2. *Sustained capacity.* Properly placed concrete has the highest flow coefficient of any pressure pipe structural material . . . will never corrode or tuberculate under ordinary conditions. And the concrete core is there "for good," because it is a structural part of the pipe.

3. *High beam strength.* Price Prestressed Pipe makes your water line safe from external loads. It is shatterproof . . . and sudden and complete failure is all but impossible.

They picked Price Pipe for other reasons, too. It's easy to lay, easy to tap and watertight. It has great economy because of low original cost, low maintenance and extra-long trouble-free life.

Get Prestressed Concrete Pipe in *your* specifications. It will give your installations the same "Longest trouble-free service at lower cost" that Chicago enjoys. Ideal for sewer lines, too. Just mail the coupon for more information.

*only CONCRETE PRESSURE PIPE MEETS THE BIG 3 REQUIREMENTS

- LONG LIFE
- SUSTAINED CAPACITY
- GREAT STRENGTH

PRICE Pressure PIPE
PRESTRESSED CONCRETE
STEEL-CYLINDER PIPE

Price Brothers Company
1831 East Monument Avenue
Dayton 1, Ohio

Please send me, without obligation, the following literature:

- ☐ Check Sheet of Water Line Requirements
- ☐ Facts on Prestressed Pipe
- ☐ Price Pipe for Pressure Sewer Lines

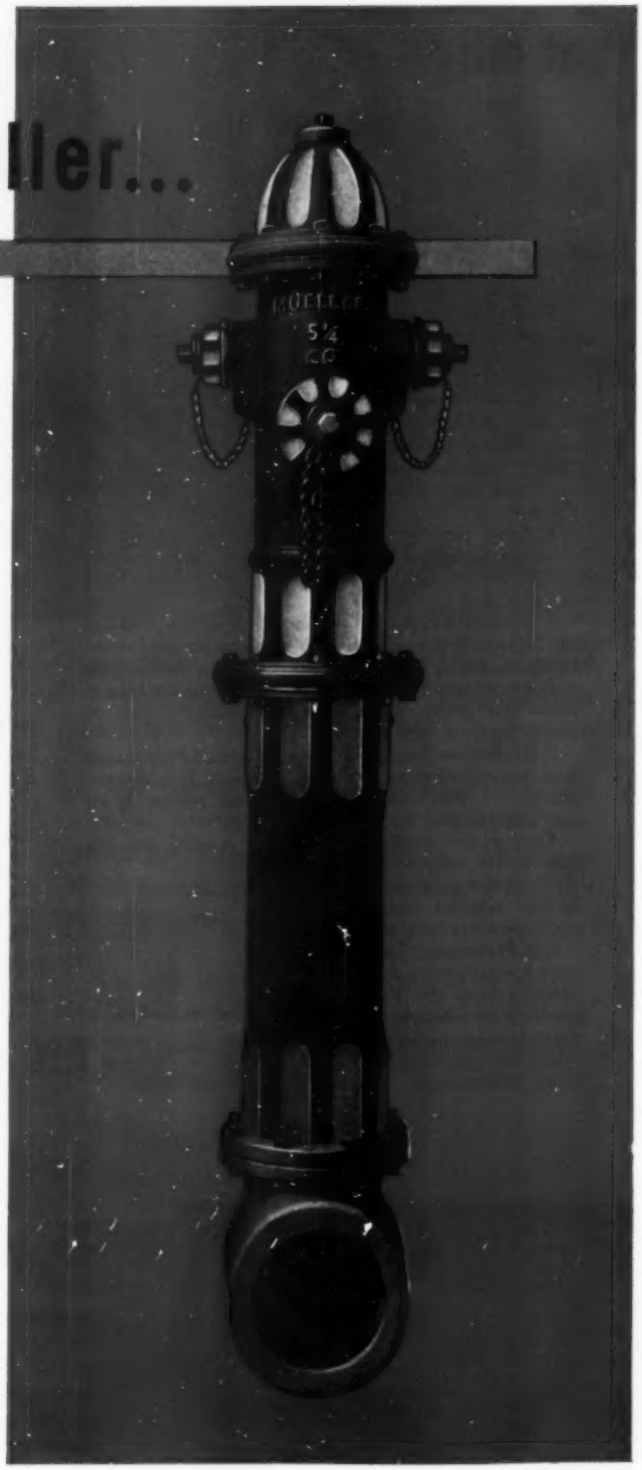
Name_____
Title_____
Organization_____
Address_____

# MUELLER®

## Specify Mueller...

### and you get all of these improved Fire Hydrant features

- AUTOMATIC LUBRICATION
- SAFETY FLANGE CONSTRUCTION
- SAFETY STEM COUPLING
- DRY TOP DESIGN
- COMPRESSION TYPE MAIN VALVE
- DOUBLE AUTOMATIC DRAIN VALVE
- "O" RING SEALS
- FULLY BRONZE MOUNTED
- BREECH-LOCKED NOZZLES
- DESIGNED FOR ABOVE GROUND MAINTENANCE



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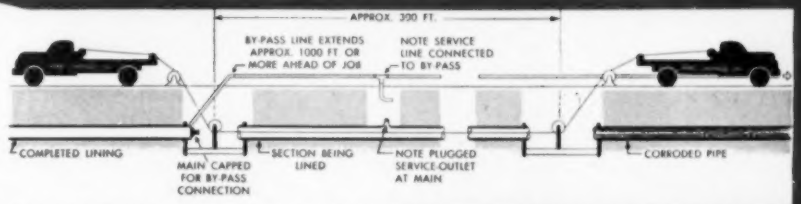
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NOTE SERVICE LINE CONNECTED TO BY-PASS
COMPLETED LINING
MAIN CAPPED FOR BY-PASS CONNECTION
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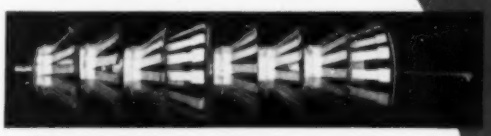
**here** is the Steel Scraper which is pulled through the pipe. It dislodges tubercles and incrustation and makes the inside of the pipe clean and smooth.



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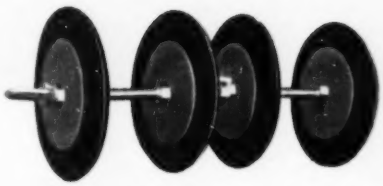

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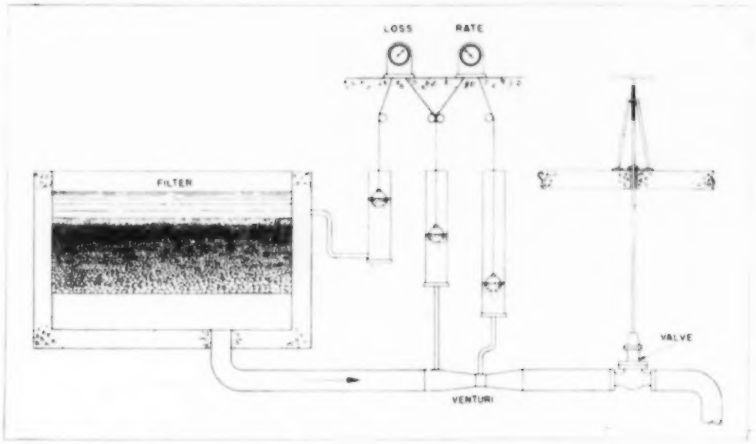



Fig. 1—THROTTLING VALVE preceded automatic control devices

50 YEARS of Invention and Development

# Effluent Rate Control for Rapid Sand Filters

From the Venturi Tube to Automatic Control and Master Supervision Devices

*by* CHARLES G. RICHARDSON, *Vice-Pres., Builders-Providence Inc. Providence, R.I.*

THE necessity of applying automatic rate control to the effluent from each filter in a municipal plant was recognized almost simultaneously with the advent of "rapid sand" filtration, near the end of the preceding century. Filtration plants which had been built up to that time then gradually came to be known as the "slow sand" type, with large bed area and manually operated main valves. For such installations it was the usual practice to install a Venturi tube in each filter effluent line, connecting with float actuated "filter gauges" located on the operating floor. As shown in Fig. 1, these gauges indicated loss of head and rate of discharge of the filter.

As the loss of head through the filter slowly built up, the desired rate of output of the filter as slowly decreased. When a specified minimum limit was reached, the operator opened the throttling gate valve a little further and thus restored the desired rate of filtration, as shown by the rate indicating dial. This method of operation was continued until the loss of head increased to a point where the throttling valve became fully open; then the filter was shut down and washed. Such installations were made at Providence, R.I.; Washington, D.C.; New Haven, Conn.; and at other cities.

Rapid sand filters, with their greatly stepped-up rate of output, required hydraulically-operated main valves—inlet, effluent, drain, wash, etc.—with control handles conveniently mounted on "operating tables." It was not found practicable to maintain the specified rate of filtration by manipulating the main effluent valve many times during a day's run: this valve was used only as a shut-off during the washing period.

By 1900, various types of rapid sand filters had been developed and installed. These were of the round steel or wood tank type, with mechanical revolving elements for agitating and washing the sand. Prominent, and highly competitive, makes were those of the Hyatt Pure Water Company, the National Water Purifying Company and the O. H. Jewell Filter Company.

## Weston Controller

In 1899, a patent was issued to E. B. Weston and W. W. Jackson, of Providence, for an "automatic regulating-weir." The specifications read, interestingly:

"The invention relates to an automatic regulating-weir especially designed and adapted, among other uses, to be employed in connection with mechanical filters in order to secure a constant rate of discharge of filtered water from the weir tank or chamber, irrespective of the height of the water column in said weir-tank and irrespective of the condition of the filter-bed. * * * It is well known to those skilled in the art that when water first begins to flow through a filter the bed is easily permeated and the rate of

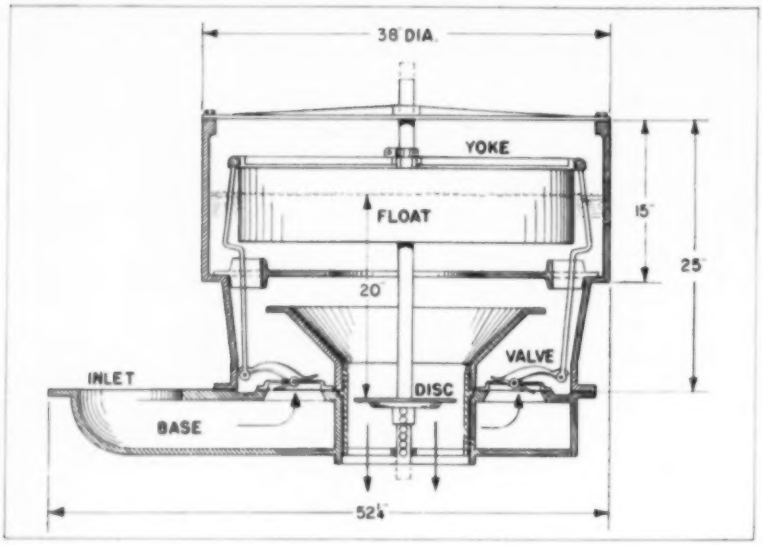



Fig. 2—WESTON CONTROLLER, the "automatic regulating-weir" patented in 1899
Dimensions are for the largest size—suitable for 1.5 mgd

discharge is much greater than can be maintained after the filter-bed has become less permeable through the collection of the coagulant generally used in filter plants or the impurities removed from the water and lying on and within the filtering medium. Practice has determined a limiting velocity or rate of discharge for each unit of area of the surface of the filtering medium, and this rate must not be exceeded if the efficiency of the filter in the removal of bacteria and other impurities is to be maintained."

Final designs for several sizes of different capacities were completed and manufacture of the device was begun by Builders Iron Foundry.

The section drawing, Fig. 2, illustrates the principal elements: the dimensions are for the largest size controller, suitable for a maximum of 1.5 mgd. The first shipment, in 1901, of thirty-two units was for the Little Falls, N.J., plant of the East Jersey Water Co. M. N. Baker, in his book *"The Quest for Pure Water,"* states that "these filters inaugurated a new era in design. In shape, they were rectangular instead of round; in structure, they were reinforced concrete rather than of wood or iron."

The inlet of the "Weston Controller" was designed to be bolted to the discharge side of the filter and a constant head of 20 inches (for this size) was maintained over the orifice disc by the large float regulating the incoming supply through direct throttling of the inlet valves. The result was a fixed rate of open

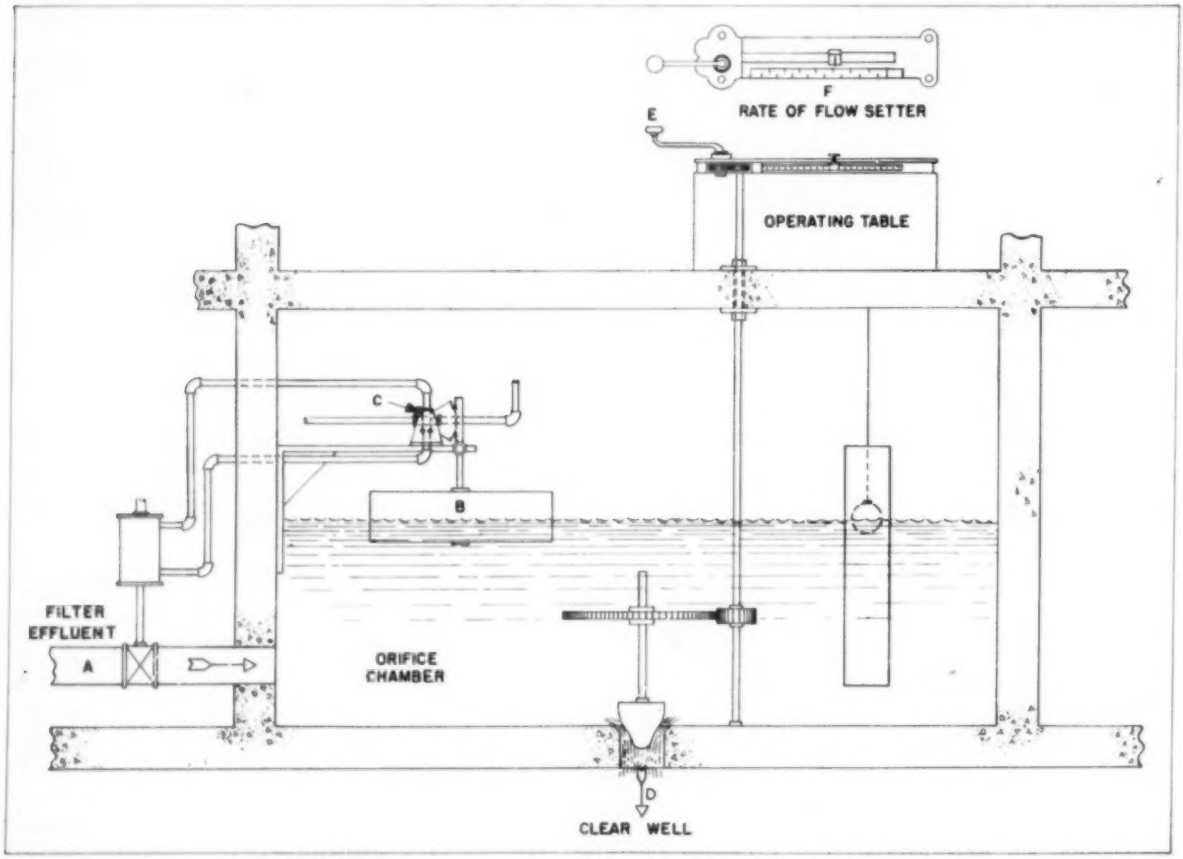



Fig. 3—HARRISBURG, Pa., filtration plant in 1904-5, equipped with ingenious automatic control

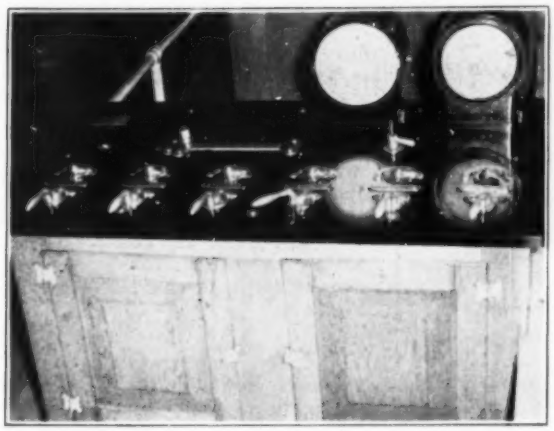


Fig. 4A—OPERATING TABLE at the Harrisburg plant
Crank for setting rate of flow is near center of table
Indicator for loss of head and chart for rate of flow

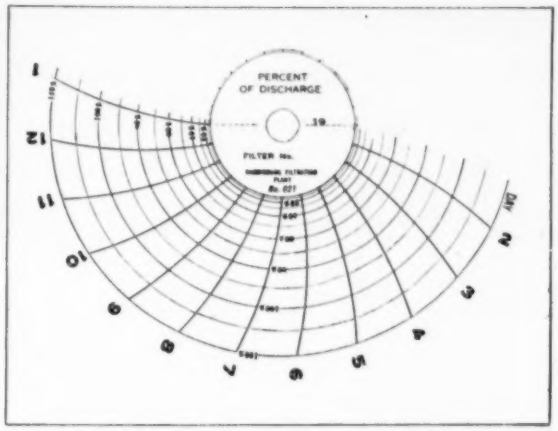



Fig. 4B—RATE OF FLOW CHART at Harrisburg plant
Curiously, chart is graduated in "percent of discharge"
This was actuated by a float in the orifice box

discharge to the clear well below. To change the rate, it was necessary to dismantle the controller and substitute a disc of different diameter. The range of selection was small; the loss of head relatively large.

A considerable number of these units were supplied, up to 1922, for both U. S. and foreign plants, the latter through the Jewell Export Filter Company, of which Mr. Weston was president.

### Little Falls Plant

Early in 1903, George W. Fuiler presented before the American Society of Civil Engineers a paper describing the new filtration works at Little Falls, N.J. There were thirty-two 15 ft. x 24 ft. filters and the nominal capacity of the plant was 32 mgd. Quoting from the paper: "Each filter is provided with an automatic controller of the well-known Weston type."

These units were each furnished with orifice discs of three different sizes, respectively for flows of 1, 1.25 and 1.5 mgd., and with a few special discs for .65 mgd. The head loss for the 1 and 1.5 discs measured 2.5 and 4.0 ft. The filters, at this time, had been in continuous operation for approximately five months, under the supervision of Mr. Fuller, and in immediate charge of George W. Johnson.

The same issue of the Proceedings of the Society contains a paper by Charles Anthony, Jr., entitled "Automatic Modules for Regulating the Speed of Filtration." The author discusses the various forms of regulating weirs, variable orifices and other devices. He comments that such units should be (a) susceptible of adjustment to any constant discharge required; (b) simple and durable, not requiring skilled attention. He concludes that "The numerous forms of semi-automatic apparatus of this description . . . appear doomed to speedy extinction." John H. Gregory, in discussing Mr. Anthony's paper, recited his experiences at the Albany, N. Y., filtration plant. Referring to effluent control, he wrote, "The apparatus consists of an orifice 4 in. x 24 in. in a brass plate situated in a cross wall of the regulating chamber. The head on the orifice is maintained constant by opening or closing a valve on the main effluent pipe from the filter." He mentioned that with a head of 1 ft. on the orifice, and a filtering rate of 3 mgd., the head loss could reach 4 ft. Readings of the loss of head through the filter were taken every few hours and, as necessary, the effluent valve was opened a little to restore the normal rate. The discussion shows three suggested designs for *automatic* effluent control and the author significantly adds to Mr. Anthony's two points that, in an automatic effluent controller, "the loss of head should be reduced to a minimum."

### Harrisburg Plant

A rapid sand plant, which attracted wide and favorable attention, was built for the City of Harrisburg in 1904-5. It was designed by James H. Fuertes, well-known consulting engineer. There were twelve filters of nominal capacity of 1 mgd. each; eight more of similar design were added in 1922. This plant is not in use at present but is ready for immediate operation in an emergency. The automatic effluent control is ingenious: its principal elements are shown diagrammatically in Fig. 3.

Below the pipe gallery floor is a large, open concrete orifice chamber

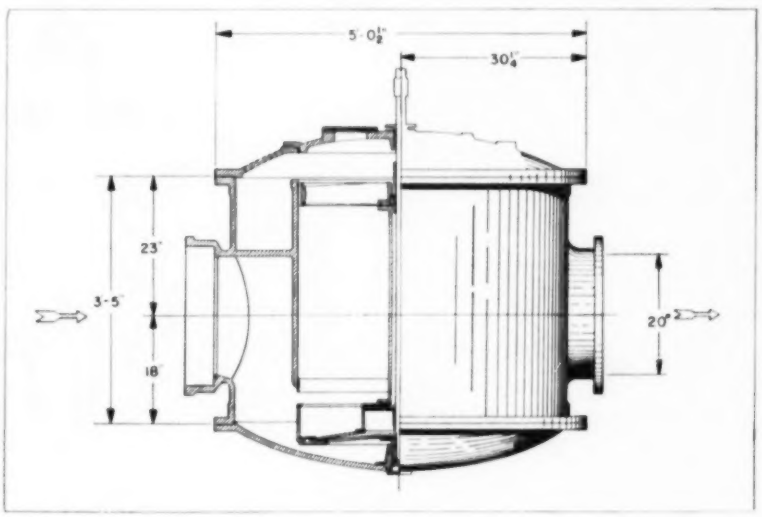



Fig. 5—COLUMBUS, Ohio, plant in 1904 included automatic rate controllers
These were designed by John H. Gregory and built by Builders Iron Foundry

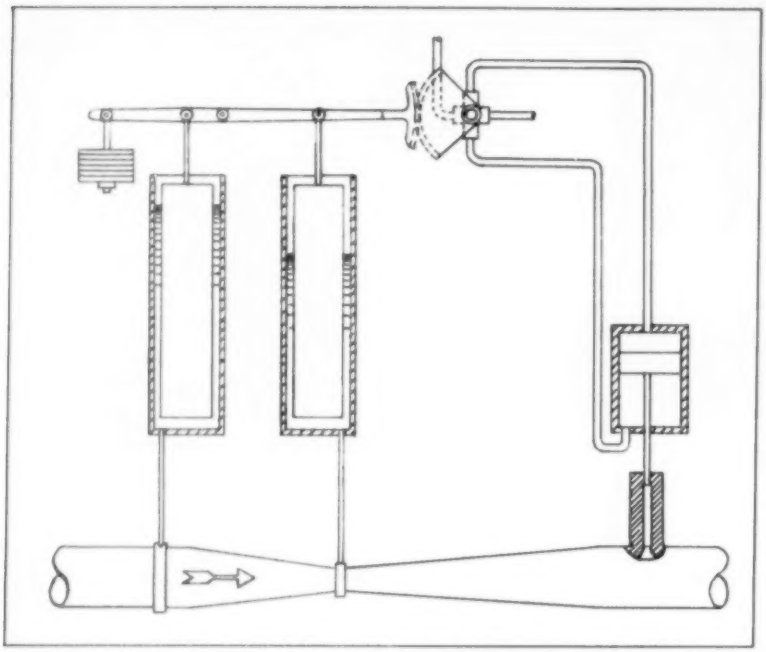


Fig. 6—CONNET PATENT, 1907, a new concept of effluent control, employing a Venturi tube

for each filter. Water is admitted through filter effluent pipe "A" and is maintained at a constant level by 24-in. diameter float "B," geared to 4-way valve "C." The latter, in turn, controls the throttling of the hydraulic gate valve in "A." On orifice in the bottom of the chamber, "D," opens directly into the clear well below. The orifice plug is of special pear-shaped section. Thus there is established a constant head over an orifice, the area of which can be changed by raising or lowering the plug. Volumetric calibrations determined the relation between the vertical position of the plug and the rate of flow. Originally the area of the orifice was controlled by an adjustable sliding plate which, however, was not used by the operators. They had the idea that the filtered water reservoir should always be kept full up to the last inch and the filters were required to deliver water at practically the same rate it was being pumped to the city. With Mr. Fuertes' approval, the orifice plate was discarded and the special plug substituted.

At the operating table, the orifice plug can be raised or lowered by crank "E" to increase or decrease the rate of filtration, as indicated by the pointer on scale "F," which is graduated directly in million gallons per day.

A photograph of an operating table is shown in Fig. 4A. On top of each table are located the usual 4-way valve handles for opening or closing the several main valves of the filter, a loss of head indicator, and a rate of flow chart recorder. The former is differentially operated from floats in pipes connected, respectively, to head of water on the filter and in the effluent; the latter is actuated by a float in the orifice box and, curiously, is graduated in "per cent of discharge." Necessarily, these graduations are not uniformly spaced. Incidentally, the loss of head dials were photographically produced from a master dial which was hand graduated and lettered by the writer nearly fifty years ago. A section of the rate chart is shown in Fig. 4B.

### Columbus Plant

Construction of the first water purification plant for Columbus, Ohio, began in 1904. There were ten filters, each having a nominal capacity of 3 mgd at a rate of 2 gallons per square foot per minute, with an allowance for 50 per cent overload. Air wash was a feature. In 1910 Mr. Gregory presented a voluminous and valuable paper, before the American Society of Civil Engineers, describing the entire works. In it, he wrote:

"The discharge of each filter is controlled by a filter controller which maintains, automatically, a uniform rate of filtration. The controller is of the closed type, is self-contained, requiring no auxiliary device for its operation. It was designed especially for the Columbus Works and

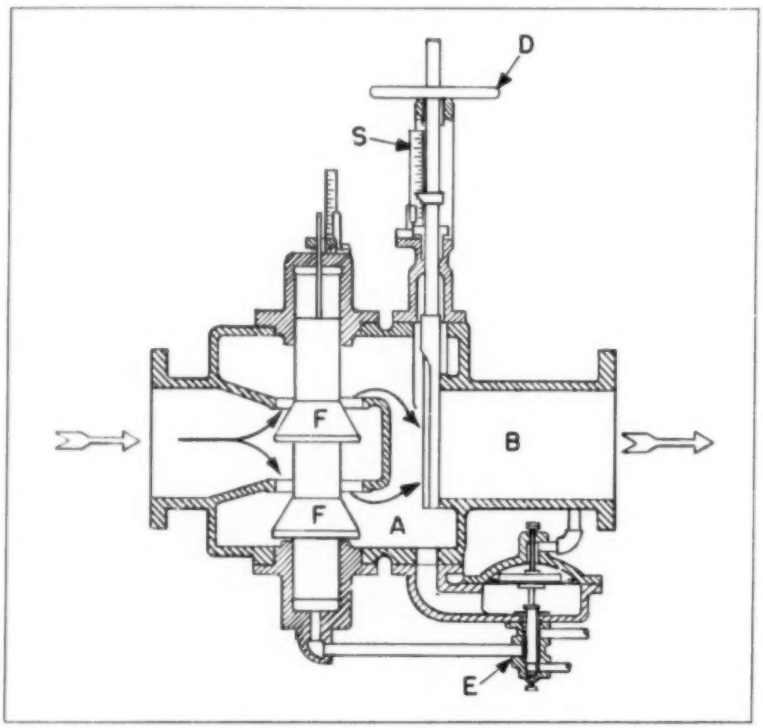



Fig. 7—VIVIAN CONTROLLER, a compact design patented in 1908 Cincinnati, Ohio, early installed units built by Norwood Eng. Co.

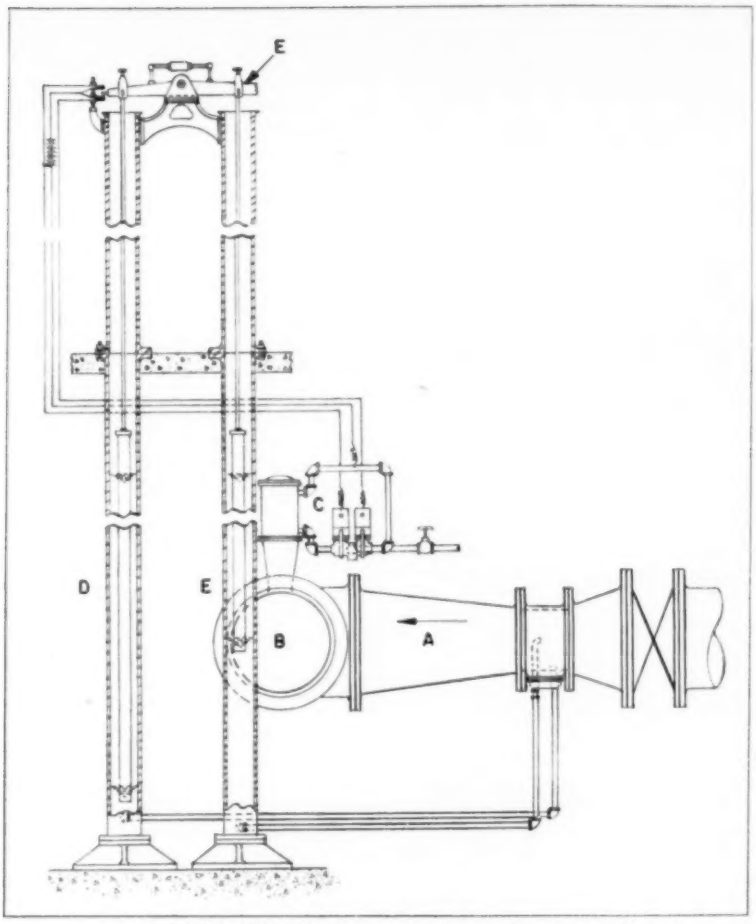



Fig. 8—EARL CONTROLLER was unique in use of magnetic valves Waco, Texas, and Montreal, Can., used twenty units

operates under a net loss of head of about 1 ft. The controller is adjustable by means of an operating stand on the floor above, and has a capacity ranging from 1 to 4.5 million gallons per 24 hours."

The controllers, illustrated in Fig. 5, were built by Builders Iron Foundry. Loss of head indicators and operating tables for main valves were a part of the equipment.

Allen Hazen, in his discussion, made this comment relative to the filter controllers:

"At the Little Falls plant the filters were built over the pure water reservoir . . . No objection to this because Weston controllers were used and, according to the practice of the time, were set about 10 ft. below the water on the filters. They were incapable of action when submerged and, therefore, the highest level in the pure water reservoir was necessarily at least 10 ft. below the flow line of the filters. Since that time, filters have been repeatedly built over pure reservoirs . . . where other types of controllers, capable of operating when submerged, were adopted . . . There are two principal reasons for keeping up the elevation of the pure water reservoir: (1) head is saved; (2) operation of plant is more convenient and satisfactory."

To this, Mr. Gregory replied:

"At Columbus the controllers are enclosed and are capable of operating when submerged in the manner outlined by Mr. Hazen."

During the period of 1910-1920 (approximately) the Pittsburgh Filter and Engineering Company was active in manufacturing equipment and building filtration plants under contract. Included were controllers of the enclosed "dome type," similar to the Columbus pattern. Among the installations made were those at Fort Worth, Texas; Williamsburg, Pa.; Flint, Mich., and Lorain, Ohio. The company suspended operations in 1922.

## First Venturi Controller

In 1907, a basic patent was issued to F. N. Connet, late chief engineer of Builders Iron Foundry, which was eventually to change the fundamental concept of practically all future filter effluent controls. The essentials of the patent drawings are duplicated in Fig. 6: the details were not, of course, confined to this design.

Briefly explained, flow through a Venturi tube placed in a filter effluent line, introduces a difference in head in the float pipes which are directly connected to the inlet and throat of the tube. The stems of the floats are attached to a top lever. The vertical movement of the floats, resulting from the Venturi differential, moves the lever to operate a 4-way pilot valve which, in turn, positions a main control valve and thus establishes the desired filtering rate. The latter can be set by weighting the lever, or by other means.

In 1909, another patent was issued to Mr. Connet which showed a direct connection between the inlet and throat pressures of the Venturi tube and the hydraulic valve piston, the stem of which could be weighted as required.

Thus there was finally obtained the requisites for a filter rate con-

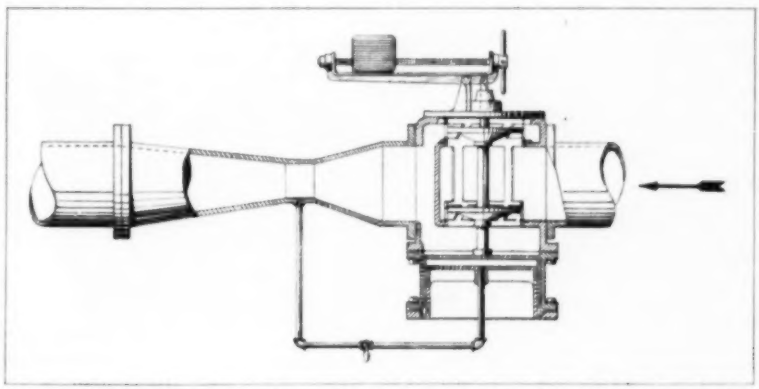


Fig. 9—LEDOUX PATENT in 1910 combined a Venturi tube and a differential actuating diaphragm

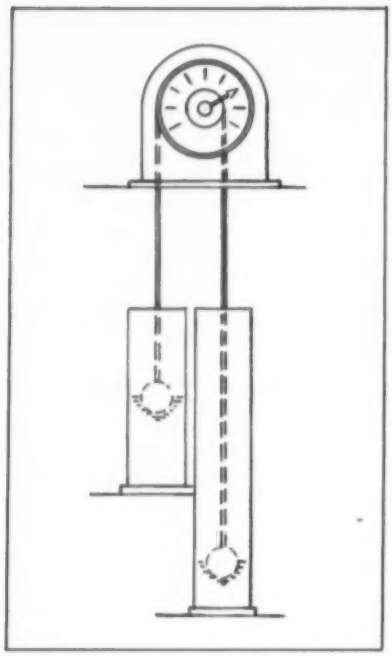


Fig. 10—LOSS OF HEAD was indicated by this earliest type of filter gauge. One float turned the dial; the other, the dial hand.

troller of maximum efficiency; minimum loss of head; simple and durable; easily set for any desired rate of control; capable of operating submerged.

## Vivian Controller

In 1908, Simon Vivian was granted a patent on a compact design of rate controller, the essential elements of which are shown in the sketch, Fig. 7.

The direction of flow is indicated by the arrows. The intermediate chamber "A" and the outlet "B" of the controller were separated by a rate valve, the position of which was manually set for any desired rate of flow by the handwheel "D" and the vertical graduated scale "S." Should the flow through the controller change from the initial setting (for instance, due to increase in loss of head through a filter bed) the resulting change in head, inlet to outlet, caused a movement of the diaphragm connected to pilot valve "E" to automatically move a throttling control valve "F" to restore the original difference in pressure across the controller, and hence to reestablish the set rate.

Controllers of this type were built by Norwood Engineering Company. An early installation was that of a 24-in., a 30-in. and a 42-in. controller installed by the City of Cincinnati. Later, owing to the cost of construction, the essential elements of this unit were combined with a Venturi tube and a master control added, as at the Erie, Pa., plant.

## Earl Controller

Between approximately 1910 and 1920, some installations were made of a unique type of rate controller (now discontinued) devised and patented by the late George G. Earl, of New Orleans. Waco, Texas, installed four such units in 1913; Montreal installed sixteen on prefilters in the city's first plant, placed in operation in 1918. These units were replaced, in later years, by other types. The Earl controller is illustrated in Fig. 8.

In the Montreal installation the effluent line from the filter contained Venturi tube "A" and hydraulic control valve "B," the piston of which was positioned by the small magnetic valves "C." Pitot tube pressure pipes were inserted in the throat of the Venturi tube. The two vertical float pipes, "D" and "E," were mounted on the pipe gallery floor and their top ends supported a balance beam "F," one end of which carried contact elements electrically connected to the magnetic valves. As flow through the effluent pipe began, a differential head resulted in the float pipes due to the Pitot tube action. The floats moved the balance beam and the resulting electric contact sent current to the magnetic valves to throttle the valve "B" until the balance beam was restored to its neutral point. This established the rate of flow for which the controller was set. Readjustment was similarly repeated automatically as the loss of head through the filter built up. Each controller also had a third float connected to the balance beam to maintain a required level in the effluent conduit from the prefilter.

## British Practice

The present British practice is to use either a "Module" or a Venturi type filter rate controller. The former incorporates an automatic throttling valve and an adjustable orifice across which a constant differential is maintained by a float mechanism. This unit is installed on the effluent side of the filter, in an open channel. In the United States, the Venturi type of rate controller is universally employed.

## Ledoux Patent

Naturally, there have been developments in designs since the original 1907 patent and, of these, the most prominent was the one patented in 1910 by J. W. Ledoux, late chief engineer of the Simplex Valve and Meter Company.

The patent drawings, see Fig. 9, show the throat pressure piped to the bottom side of either a floating or a fixed flexible diaphragm which is directly connected to a vertical double poppet type valve in the end of the controller unit. The pressure in this chamber acts on the top side of the piston. The valve assembly is counterweighted by an adjustable weight which can be set by scale to produce the required rate of flow. If the rate decreases, there is an accompanying decrease of the differ-

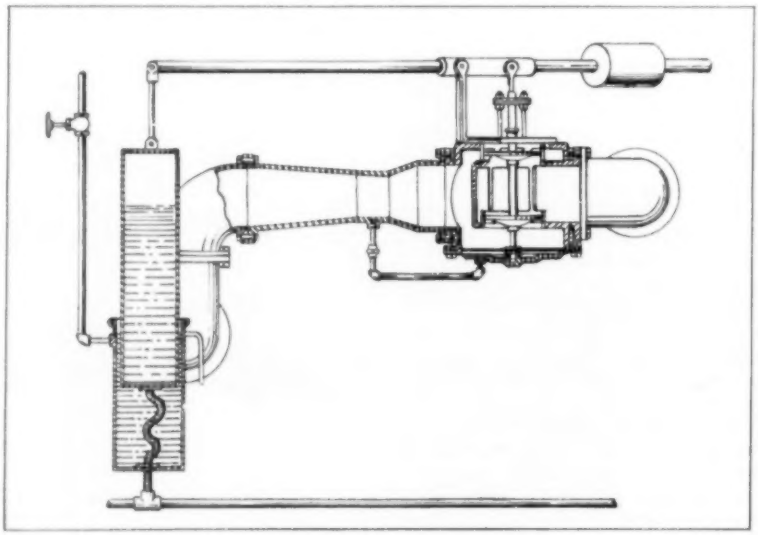


Fig. 11—BORDEN PATENTS in 1926 and 1938 related to hydraulic master controls The representative design illustrated shows one automatic system

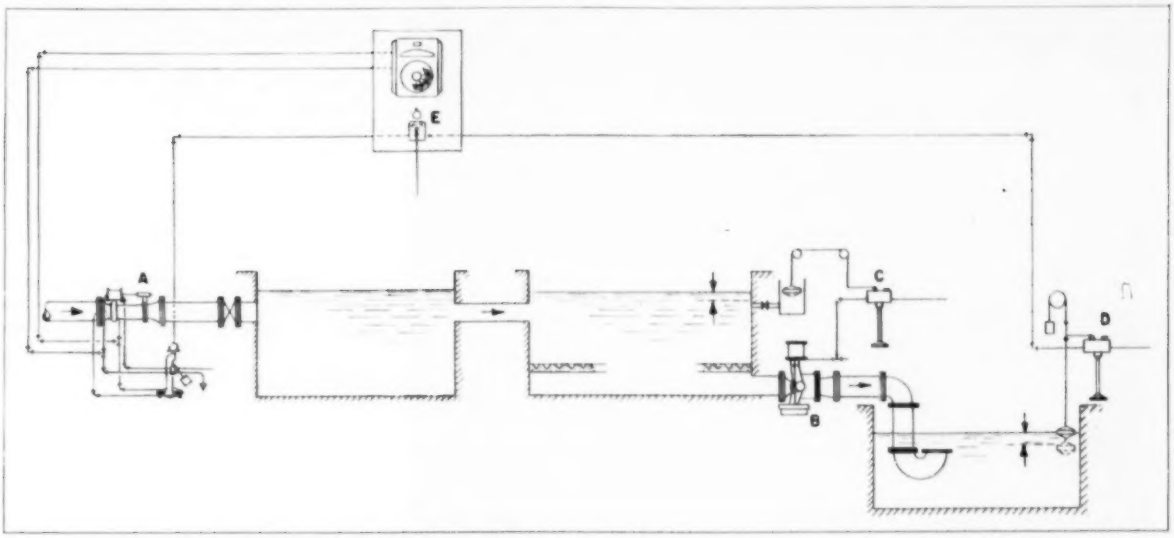



Fig. 12—COMPREHENSIVE MASTER CONTROL to maintain water level on filters and in clear well. Hydraulic piston (A), diaphragm actuated units (B), Master Control units (C and D) and a transfer switch (E) comprise this Builders-Providence, Inc., system

ential pressure across the diaphragm or piston which opens the poppet valve sufficiently to restore the balanced position of the assembly and thus to re-establish the set rate.

Space does not permit a description of the various changes in design of Venturi rate controllers which have been made in both the hydraulic piston and diaphragm types. Mainly, they have been in the actuation and pattern of the control valve: butterfly, gate, segmental vane, rotating disc, etc.

## Filter Gauges

Rapid sand filtration emphasized the importance of "filter gauges" as complementing automatic filter rate control. The sketch, Fig. 10, illustrates the earliest type of installation for a loss of head unit.

Originally, one of the floats turned the dial; the other, the dial hand. Hence, the resulting dial reading was the difference in elevation of the float, or the loss of head. This often resulted in the dial letters and numerals being at an angle, or even upside down, making accurate observation difficult, as well as presenting a poor appearance. In 1909, both Mr. Connet and M. M. Borden (consulting engineer of the Simplex Company) were granted patents on differential arrangements of interior gearing, which resulted in maintaining a fixed position of the dial, the dial hand only being turned. Such gauges, of course, were applicable to loss of head and also to rate of flow measurements. Later, chart recording dials were added and, more recently, devices to measure sand expansion.

For a rate of flow indicator, the two float pipes would be connected, respectively, to the inlet and throat pressures of a Venturi controller. Float pipes, however, often proved awkward to install and occupied too much space in the pipe gallery. These were superseded by mercury differential float chambers or diaphragm pendulum units. The latter are placed on the pipe gallery floor and operate the filter gauges by flexible cable and pulley drive.

## Master Control

Individual controls are, themselves, subject to Supervisory or, as more commonly termed, Master Control. For instance, in the diaphragm actuated type of controller it was found undesirable, especially in the larger plants, for the operator

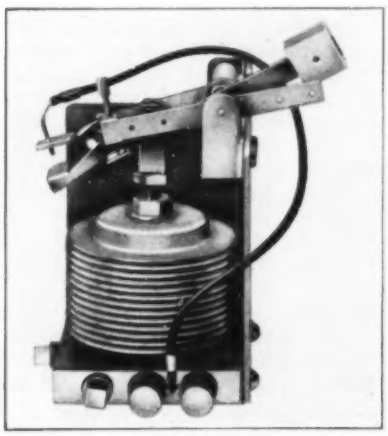


Fig. 13—BELLOWS UNIT in pneumatic transmission device—one for loss of head and one for rate of flow

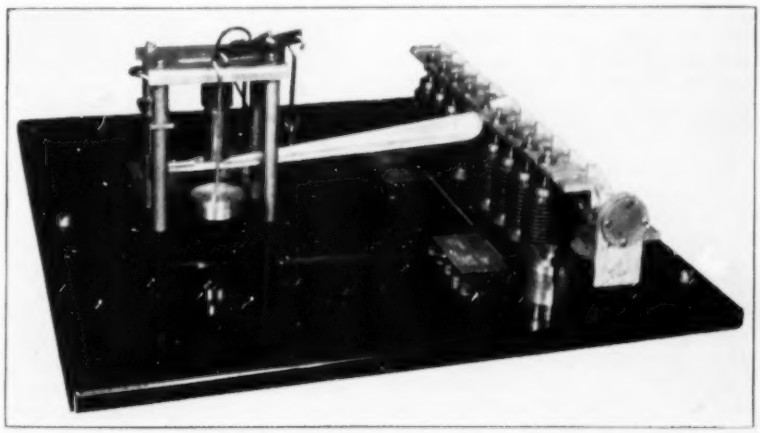


Fig. 14—SUMMATION UNIT—one for each gallery of 20 filters in Chicago's South District Filtration Plant. The pneumatic transmission and summation system was developed by Builders-Providence, Inc.

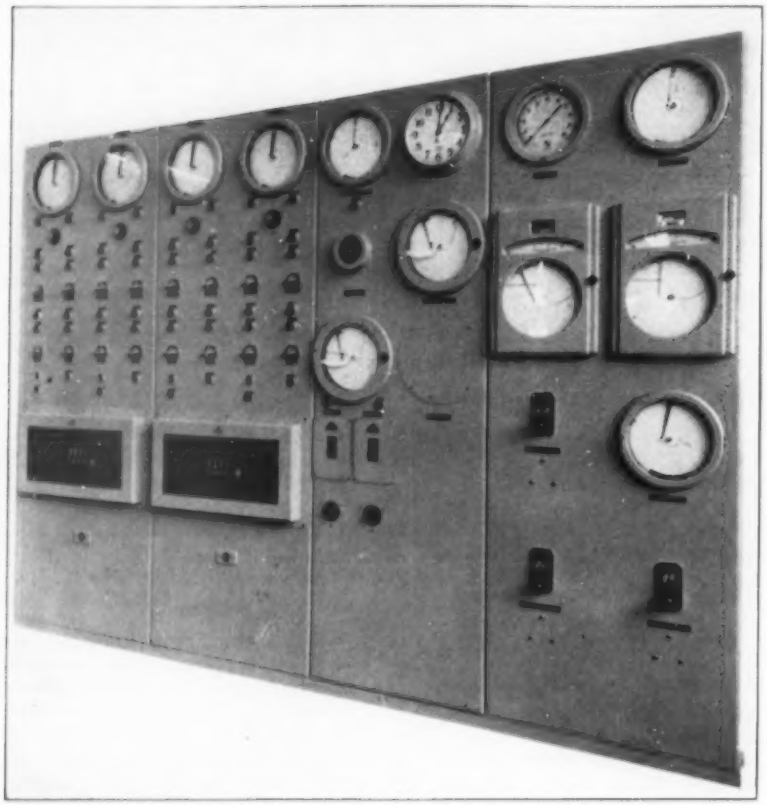


Fig. 15—ALEXANDRIA, VA., installation. Main instrument and control panel

to go down into the pipe gallery to alter the setting of the controller whenever a new rate through the filters was required.

An early improvement was to move the controller rate setting weight along a screw by means of a small electric motor, controlled from a switch on the operating table; the weight was moved until the new rate desired was observed on the adjacent rate indicator dial. Master Control, however, soon assumed broader aspects. In 1926, and again in 1938, Mr. Borden obtained important patents covering various combinations of hydraulic master controls for the type of controller mentioned. One representative design is illustrated in Fig. 11.

Quoting from the description, the arrangement provides "an automatic or master control system whereby the fluid level at a remote point is made to control the effective weight of a counterbalancing means." It will be clear that the weight of the liquid counterweight can be altered, either by connection to a basin, like a clear well, or by the introduction of water through an outside, manually controlled source.

An arrangement for a comprehensive master control system (Builders-Providence, Inc.) is shown by the diagrammatic sketch. It will be noted in Fig. 12 that both the hydraulic piston and the diaphragm actuated types of controller are shown at "A" and "B" respectively.

The special Master Control Unit "C" is set to the maximum allowable filtration rate. Its normal function is to maintain the water level on the filter at such rate. A similar master unit is located at "D": its purpose is to control the water level in the clear well by throttling the incoming raw water rate through Venturi controller "A." It will be noted that there is a transfer switch at "E" for manually setting this controller if desired.

## Electric and Pneumatic Gauge Operation

More recently, engineers frequently have been insistent that filter gauges for the larger plants be operated either electrically or pneumatically. The trend is definitely toward pneumatic actuation, although some plants employ electric. A conspicuous example of the latter type is at the Providence, R.I., filtration plant, where not only the main valves are electric motor driven, but also the rate controllers and the instruments. Some 50 indicating and recording gauges are mounted on an attractive central control and instrument board 53 ft. long, an arrangement which has proved very successful in the economical operation of the plant.

When the equipment specifications for the South District Filtration Plant of Chicago (the world's largest) were issued, it was stipulated that the filter gauges must be actuated by means other than cables. These gauges are to indicate individual loss of head, rate of flow and sand expansion for each of the eighty filter beds, plus rate summation for each gallery of twenty filters, master clear well level control, etc. The requirement led to the completion of the development of pneumatic transmission, receiving and integrating mechanisms.

For the individual filters, the loss of head and rate of flow pendulum units, mounted in the pipe gallery, are fitted with a bellows element. See Fig. 13. A continuous supply of air (under low pressure) is introduced, and the design is such that there is a single outgoing resultant pressure which is directly proportional to head loss or flow rate. This pressure is conveyed to the receiving indicator or recorder, on the operating floor, through ¼-inch tubing.

This single pressure, by direct connection to a bellows unit in the receiver instrument, continuously positions the dial hand or chart pen.

Summation of flow from each gallery of twenty filters is ingenious and was also developed by Builders-Providence. A "summation unit," mounted on the pipe gallery wall, consists of twenty bellows diaphragms, each receiving the air pressure proportional to the rate of flow through the Venturi effluent controller. The diaphragms impress their movement upon a common lever mounted on knife-edges. See Fig. 14. Opposing the resulting lever movement is a bellows unit with bleeder valve which sends out to the receiver gauge, on the floor above, a single pressure directly proportional to the sum of the rates of flow from the twenty filters. In addition, the flow of two galleries, forty filters, is reported on large summation indicator dials.

The filter gauges at the South District Plant are very complete and include four master gauges, one for each gallery.

Other recent and elaborate installations of main line meters, filter effluent and backwash control, and

overall automatic master supervision are to be found in such plants as those at Alexandria, Va., (American Water Works Service Company) and the new Nottingham Plant of the City of Cleveland, Ohio. The photos, Figs. 15 and 16, illustrate the comprehensive instrument boards which centralize, record and guide the operation of all important units.

### Highlights of 50 Years

Manifestly it has been impossible, in this article, to recite more than some of the highlights of a 50-year story of advancement in filter rate control. It is indeed a far cry from the Venturi tube in the effluent line and the water float operated gauges of the slow sand filter plant to the automatic control and master supervision of rapid sand filtration.

Fig. 16—CLEVELAND, Ohio, installation.
New Nottingham Plant central instrument and control board

### Acknowledgement

The author expresses his appreciation for the information contributed by engineers and others: especially F. H. Weed, Consulting Engineer, New York City; D. Morey, Jr., Consulting Engineer, Dallas, Texas; W. S. Mahlie, Superintendent, Water Department, Fort Worth, Texas; P. S. Wilson, Glen Ridge, N.J.; Superintendent Roberts of the Harrisburg plant; Marshall Houghn, Engineer, Division of Water, Columbus, Ohio, and W. G. Ardley, London, England.

# Richardson 50 Years with Builders Iron Foundry

## Honored at Service Award Dinner

Charles G. Richardson, Vice President, Builders-Providence, Inc., Division of Builders Iron Foundry, Providence, R.I., completed half a century of association with his company on Feb. 16, 1953. In recognition of that period of service, Mr. Richardson was presented a watch and billfold by Henry S. Chafee, Treasurer of the company, and was honored at the annual service award dinner of the organization.

Mr. Richardson has served not only his company, but the water and sewage industry as well. Known as "Charlie" throughout the country, his professional history parallels and is a part of the growth of water purification and sewage treatment since 1903.

A graduate of Brown University with the degree of Mechanical Engineer in 1900, Charlie Richardson spent two years on the drafting board at Brown & Sharpe Manufacturing Company. Then he joined Builders Iron Foundry, where he was Assistant to the late F. N. Connet, Chief Engineer, until Mr. Connet's death in 1935. He has been Sales Engineer, Manager of Sales, and since 1944, Vice President of Builders-Providence, Inc.

In the course of 50 years, Charlie Richardson has travelled widely in the United States, Canada and Europe. He has invented a number of flow metering, controlling and proportioning devices. He early developed the technical formulae for the measurement of the flow of air and gas through Venturi tubes.

Richardson (left) receives presentation gift from Henry Chafee

Charlie is the author of more than fifty technical articles including: "Function and Design of Air Chambers," "Method of Locating the Decimal Point in Slide Rule Calculations," and "Venturi Meters for Sewage and Sludge Flow Metering and Controlling." Much interest has been expressed by engineers in his recent historical bulletin, "Clemens Herschel and the Venturi Meter." His latest historical article is entitled "Effluent Rate Control for Rapid Sand Filters." *(Lead article, this issue.)* There are many who know Charlie as a humorist—he has appeared on several convention programs to present his illustrated lecture, "Humor Patented—A Collection of Screwball Inventions."

In professional organizations, Charlie is a life member of the American Society of Civil Engineers, the American Water Works Association, and the Providence Engineering Society. He is a member of the New England Water Works Association, New England Sewage and Industrial Wastes Association, and Brown Engineering Society. He is also Past President of the Providence Section of the American Society of Civil Engineers; and for several years served on the Board of Governors of the Water & Sewage Works Manufacturers Association.

Charlie Richardson's associates and many friends are proud of him and of his accomplishments.

MODERN water treatment plant of the University of North Carolina at Chapel Hill

# Water for Education

## The University of North Carolina's New Water Treatment Plant

*by* MAX D. SAUNDERS, *Supt. of Water Treatment, Univ. of North Carolina, Chapel Hill, N. C.*

THE University of North Carolina, located at Chapel Hill, N.C., owns and operates its own power plant, electric and water utilities, and telephone exchange. In addition to supplying the needs of the University, these utilities serve individual customers in and near the Town of Chapel Hill. The sewage treatment plants, owned and operated jointly by the University and the Town, are supervised by the City Manager.

In May 1950 the University's new 3 mgd water treatment plant was placed in operation—one and one-half years after the start of construction. Since the University first opened its doors in 1795, the water supply has been expanded several times to keep pace with the growth of the educational facilities: from only a few hundred students in 1800 the enrollment reached a peak of 7500 during 1951.

### Meeting Increasing Water Needs

The Old Well, which has now become a landmark of the University, first supplied the water necessary for the students and faculty. As the enrollment increased, it became necessary to build a filter plant and standpipe which were completed about 1910. This plant supplied water until 1923 when a 1 mgd plant was built to replace the old one. It was thought at this time that there would never be a demand for over a million gallons of water a day. A 250,000 gallon elevated tank was also completed to replace the standpipe.

Raw water was obtained from two small creeks that were used at different times, depending on which creek had the most water. It soon became apparent that it would be necessary to secure a larger and more dependable source for raw water.

A survey was made and it was decided to build a dam to impound Morgan, Neville, and Price Creeks about three miles west of Chapel Hill. An earth and concrete dam was completed in 1932 with a capacity of 610 million gallons. From University Lake raw water was pumped through a 12-in. C.I. pipe.

During 1935 the consumption for the year was 163 mg, and by 1940 had reached 255 mg for the year. It could be seen from this increased consumption that the plant would have to be enlarged soon to meet the demand for water.

In December 1938, while washing the clear water reservoir, several buckets of sand was found that had passed through the filters. During December 1939, new sand and gravel, and a new underdrain system were installed in the two 0.5 mgd filters. On examining the old cast iron laterals about 10 per cent of the holes were found to be enlarged which explained why the sand was passing through. The sand and gravel was found to be in very good condition with only a few mud balls after 15 years service. In order to increase the rate of filtration from 2 gal. per sq. ft. per min. to 3 gal., a larger size sand was used to replace the old sand. It was found that with good coagulation there was no problem in operating at the high rate except that the amount of wash water used was increased.

During 1940 the water consumption continued to increase. The Univerity expanded with the completion of several new buildings such as the Medical Building and three new dormitories for women students. As early as October 1941, the demand for water was beginning to tax the raw water pumping capacity which at that time was 600 gpm through a 12-in. cast iron line. The plant was operated 24 hours per day Monday through Friday, with a few hours shut-down on week-ends for needed repairs. After the outbreak of war, in December 1941, the need for expan-

LABORATORY is L shaped—has east and south exposure:—with units for chemical and bacteriological tests
Sample table, pictured on left, provides raw, treated, settled, filtered and finished water

sion was postponed for almost a year as students left for military service.

### Demand Increases in Wartime

Early in 1942 The University was selected as one of the sites for a Navy Pre-Flight Training School. Needless to say this put quite a strain on the existing water plant. In May 1942 the Navy installed a 1000 gpm raw water pump and a 12-in. Transite line from University Lake to the filter plant. These facilities made it possible to pump all the raw water needed but left the clear water storage inadequate. This reservoir, with a capacity of 250,000 gal., could be utilized to only half of its capacity, due to the elevation of the filter effluent line being at the half full mark of reservoir wall. With the reservoir half full the water would back up and finally cut the filters off.

This condition was caused by not carrying through the plans to build a new reservoir, and by using the one that was designed and used for many years to serve an older plant.

In order to use the top half of the reservoir, it was decided to install a pump in the effluent line from the filters and pump water into the upper half. A 1000 gpm deep well pump was selected and installed in June 1944. This, of course, was not good water works practice, to pump direct from the filters but at the time there was no other alternative. A four inch vent line was installed between the filters and the pump suction to prevent a vacuum.

The additional storage enabled the plant to meet the demand placed on it by the Pre-Flight School. It was interesting to note that with a training school of this kind, the peak loads taxed the storage capacities—as almost all the cadets used water at the same hours.

During 1943, when the Pre-Flight School enrollment reached it maximum, the daily consumption was almost 1 mgd. This being the capacity of the plant, it was sometimes impossible to turn out clear water with the mixing and settling facilities available. Fortunately the chlorinators were adequate in capacity so that the water was at all times of safe sanitary quality. The Navy Authorities required a much higher residual of chlorine than previously maintained and this caused quite a few complaints from customers near the plant. Ammonia was added along with chlorine after August 1944 in order to carry a chloramine residual into the distribution system. This corrected tastes, and odors, due to chlorine and helped hold some others to a minimum.

### Serious Post-War Situation

After the Pre-Flight School closed in October 1945, the water consumption dropped to less than 1 mgd for a year. As soon as enrollment started to increase due to the G. I. Educational Bill, the demand for water began to rise. At about this time, the University undertook the largest expansion program in its history. New buildings were started and temporary wooden buildings were put up to try to take care of the increased student body. It was soon realized that the water plant capacity would have to be expanded as soon as possible. The immediate problem was to try to supply the demand until a new plant could be planned and built.

During the next few years there were many days when the total storage of finished water was less than 200,000 gal., or about four to six hours supply. A breakdown for any length of time would have found the University and Town without water for fire protection or domestic use as the daily pumpage was from 1.2 to

CHLORINATORS are two 200 lb. per day W&T machines connected to panel for distribution to several points of application

CHEMICALS—alum, carbon, primary and secondary lime—are fed by four similar Omega volumetric dry feed units

WHEELER false bottom underdrain system is used in filters—this shows placing of thimbles in construction

FILTERS have 12 in. of gravel and 27 in. of sand—this shows placing gravel layer above the special balls

1.5 mgd. In June 1949, the elevated tank was completely empty for several hours on two consecutive days with all pumps operating at their maximum capacities. Pressure was maintained in the distribution system but was very low in some areas.

An Army Mobile Filter Unit was purchased and placed in operation during April 1948 to add to the capacity of the water treatment plant. Settled water from the basins was pumped through this filter without any additional chemical dosage. This unit had a maximum capacity of 150,000 gal. per day which often was enough to prevent the clear water reservoir from being pumped dry. There were many days when it seemed the supply would be exhausted but only once did the water give out completely.

### New Treatment Plant Provided

The contract for a new 3 mgd water treatment plant was signed on September 11, 1948. Wm. C. Olsen, Consulting Engineer of Raleigh designed the plant and the general contract was awarded to A. H. Guion Co., of Charlotte. A site for the new plant was selected about two miles west of the existing plant toward University Lake. This location was selected for several reasons: land available for future expansion, and location of two 12-in. raw water lines that could be converted to finished water lines after completion of the new treatment plant.

Construction of the new plant started in February 1949, and from that time on there seemed to be a race as to whether the University would have a water shortage before the plant could be finished. There were many days when the supply was almost exhausted and, finally, on April 28, 1950, the reservoir and elevated tank were dry from 1:00 PM to 10:00 PM. Only in the lower sections of town was there any water at all and this was being consumed as fast as the lines filled up. There happened to be a meeting of sanitary engineers in town at this time and many had their first experience of turning a faucet and having air sucked in instead of having water rush out.

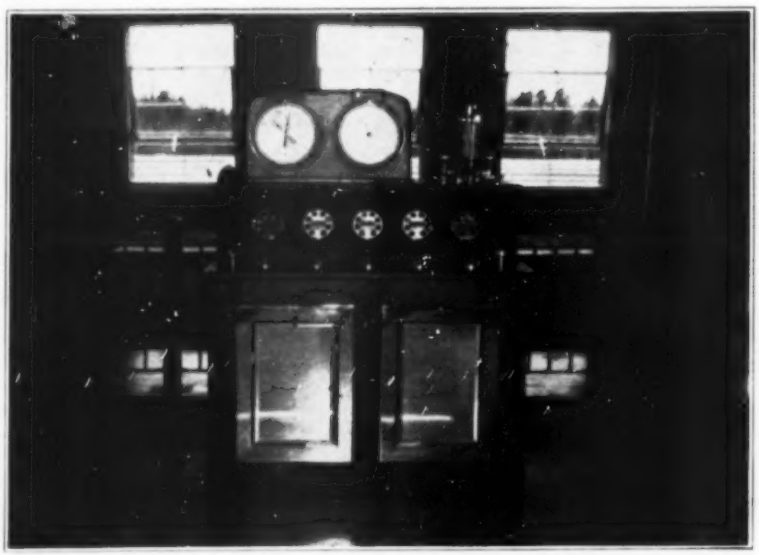
At this time there was over 700,000 gallons of finished water in the reservoir at the new plant but not enough water pressure to prime the pumps. It was decided then that there should be a vacuum pump connected to the pumps so that they could be primed without pressure from the distribution system.

The day after the water failure the University started operating the new plant even though it was not finished. It was necessary to operate finished water pumps from both old and new plants for several weeks in order to have adequate pressure in distribution system. After several connections were made from the existing system to the two 12-in. mains from new plant, the old plant could be abandoned.

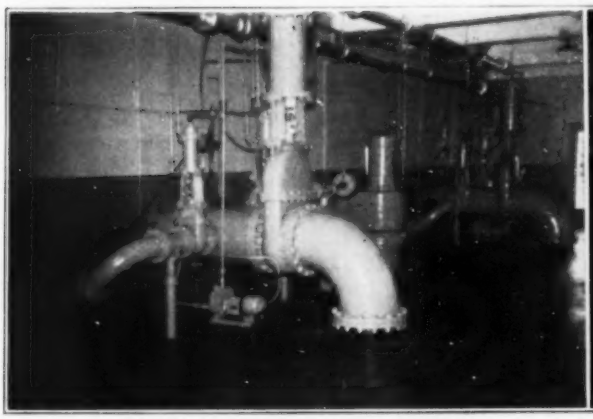
Several weeks after starting the new plant, the 12-in. Transite main to town blew out about 11:00 AM one morning, and drained almost half the water from the elevated tank before the break was found and cut off. The 12-in. C.I. main, due to its corroded condition, could not supply enough water to meet the demand. This line was cleaned from the lake to the treatment plant and from the plant to the tank in September 1950, using University labor and equipment from Pittsburgh Pipe Cleaner Co., Pittsburgh, Pa. The "C" value after cleaning this line checked out to be only a little less than that of the Transite Line.

### All Modern Equipment

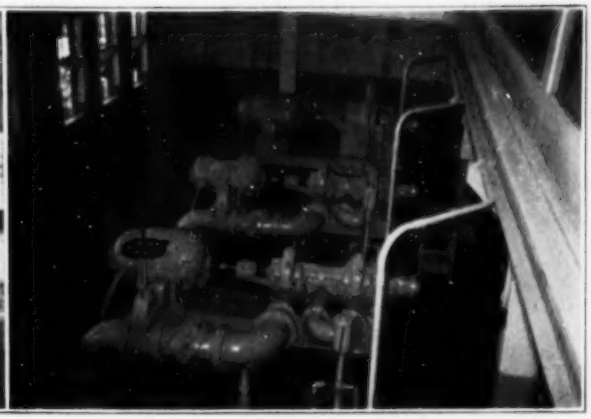
The new water treatment plant is modern in every respect, and has all equipment (including pumps, chemical feeders, chlorinators, etc.) needed



OPERATING TABLE for one of three filter units—these are by Builders-Providence



PIPE GALLERY—light and unusually spacious



PUMP ROOM—wash water pump in background

to enable the operators to do their job better. In the laboratory is located a sample table where five different samples of water are pumped for analysis. Visitors to the plant seem to be impressed with this table, as it shows them the condition of the water from start to finish. The laboratory is equipped to run any type of test needed to insure the provision of pure water for consumers.

Processing of the water is similar to that used in most water treatment plants. Alum, carbon, and primary lime when needed, are added just ahead of a flash mixer. Pre-chlorination is applied to the raw water before the flocculators. After flocculation and sedimentation the post chlorine dosage is added before water enters filters. A chlorine residual of 1 ppm is maintained in water passing through filters. After filtration, secondary lime is added for corrosion control and then the water flows to a 1.5 mg reservoir from which it is pumped to the distribution system.

There are four Omega volumetric dry feed machines for alum, carbon, primary and secondary line. Two Wallace & Tiernan Chlorinators are so connected by a panel board that chlorine can be fed from either or both machines to several points as required. The three 1 mgd filters have Wheeler false bottom underdrain systems, with 12 inches of gravel and 27 inches of sand. Palmer "Filter Sweeps" are used to insure a good wash and to keep the sand in the best possible condition. Wash water pump rate is controlled by a Builders-Providence automatic controller operated from the filter operating floor. Finished water pumps of 1400 gpm and 2100 gpm are wired to cut off when the elevated tank is full as this tank floats on the system. Raw water pumps of 2300 gpm are controlled from the plant by remote control push buttons.

Builders-Providence Venturi meters are used for measuring the flow of raw water as well as of finished water, All meters, filter equipment, operating tables, etc. were furnished by Builders-Providence, Inc., as were the elevated tank and reservoir control gauges. Flocculating equipment was furnished by The Door Co. American Well Works Co. supplied the flash mixer.

The University now has a water treatment plant that should be able to meet any demand made upon it for several years before making further additions to the plant. The immediate problem is to provide more elevated storage and larger mains for the distribution system. As the University and Town of Chapel Hill continue to grow, it is probable that plant expansion will be required in the normal course of event. Without education the world would stand still, and without water our education could not endure.

# NEW WATER & SEWAGE REPORTS

**Methods of Financing Sewers and Sewage Treatment Works in West Virginia.** State Dept. of Health and State Water Commission. Publication No. 8 of the Bureau for Government Research. 1952. (West Virginia University, Charleston, West Va.)

The report is divided into five parts and an appendix:

I. The problem of pollution in West Virginia

II. The agencies concerned with pollution control

III. The problem of the cities—where to get the money?

IV. The small incorporated and unincorporated areas

V. Conclusion and recommendations

Appendix A. Summary of methods of finance

Appendix B. Status of sewage treatment, cities and towns, 1952

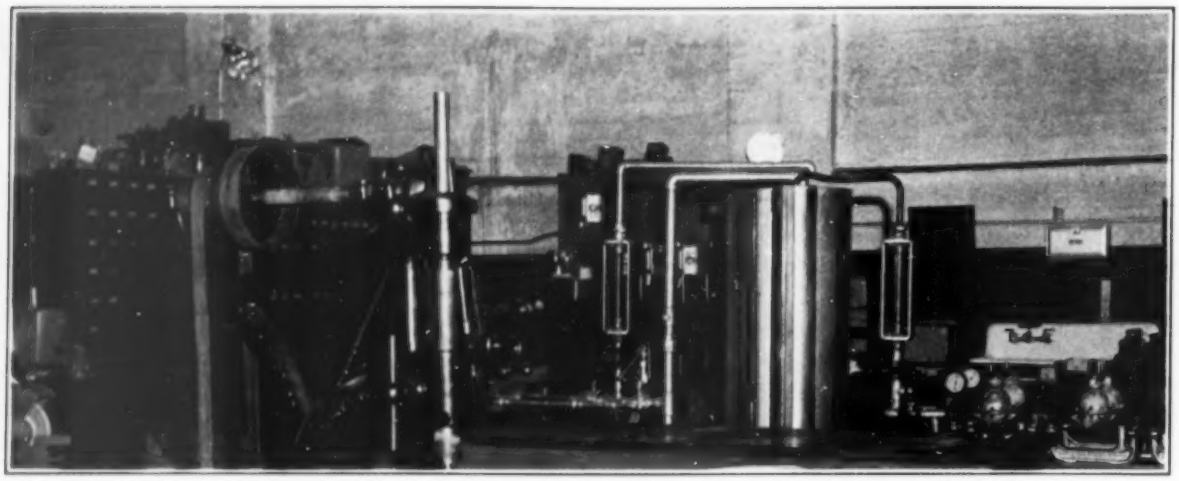
"There are only 19 municipal sewage disposal plants in the State and of this number the State Water Commission considers only 6 to be adequate" . . . "There are 215 municipalities in West Virginia. Sooner or later nearly all of these places must be served by sewers and sewage treatment plants."

Authority to combat pollution is in the hands of the State Water Commission, and the State is also a participant in the Ohio River Valley Sanitation Commission.

There are five methods of financing sewage works: 1. Allotments from the general fund; 2. General obligation bonds; 3. Special assessment bonds and certificates; 4. Revenue bonds; and 5. Service charges. Thorough discussion is devoted to the advantages and disadvantages of each method.

Zoning of all the streams in West Virginia has been completed by the State Water Commission (there are four classes, AA, A, B and C, depending on water quality). Seven recommendations presented are designed to combat the pollution problem by suggesting suitable municipal financing and by correcting fundamental weaknesses existing under present statutes.

The Bureau for Government Research is directed by C. M. Frasure.



TEST BENCH—located at the center of the repair shop for maximum efficiency

# Repair Shop and Test Program for Large and Small Meters

## Practical Hints on Maintenance, Repair and Testing

*by* J. E. MOSES, *General Foreman, Water and Sewer Dept., Durham, N.C.*

A PROPERLY maintained water meter is a scientifically accurate device, and as such is fair to the water user and the water company alike.

Long before a neglected meter turns over for the last time and stops completely, the water actually flows through the meter at one gallon or less per minute. Most water leaks fall into the low-flow class.

To collect all revenue possible, to prevent water waste, and to spread the cost of the water system in an equitable manner, a planned program of meter repair and testing is a "must" for all water-works, large and small.

How often a meter should be repaired and tested depends largely on local water conditions. We have found a five-year schedule is a good one to start with for small meters; this can be lengthened or shortened on the basis of experience. Large industrial or main line meters should be tested every few months.

### Planning the Meter Shop

Each shop should contain the following equipment:

*Necessary*

Test bench and tanks
Meter disassembly table
Meter cleaning sink
Small repair bench for gear trains, etc.

*Optional*

Filing cabinet for records
Desk
Cabinets or bins for repair parts

The meter test bench should be located at the center of the shop for maximum efficiency, for here the meter is tested both before and after repairs.

### Importance of Testing At Minimum Flow

Tests should be made at full flow, minimum flow, and intermediate flow. The water meter is tested by an accurate testing device, permitting final adjustments which give an old meter all the accuracy of a new meter.

The flow rate of house-service water meters is ¼ gpm or less. When the meters are not properly maintained, most of this water is either unrecorded or greatly under-registered. Therefore, no repaired meter should leave the meter shop until it is better than 95% accurate at ¼ gpm.

### Repair and Testing Step by Step

In these instructions we describe only the most important items in the repair of a meter.

Keep together the parts of each meter being tested.

1. Remove register box screws and lift off the register box. Lift off the register.

2. To remove register change gear, pinch end of spindle carefully and pull gear off. Remove stuffing box change gear. Gears on meters with open type gear trains may stick, and may be removed at same time as stuffing box.

3. Remove stuffing box nut using a suitable ¾" socket wrench. Remove and throw away old packing. Examine nut for defects.

4. Remove the bottom cap bolts, nuts and washers, and pry off bottom cap. Do not save gasket.

5. To remove measuring chamber from case, use a mallet. Since the measuring chamber is tapered, a few light taps are sufficient. Do not damage dowel pin or thrust roller bearing plate.

6. Remove gear train clamp nut with a ¾" socket wrench.

7. Cleaning: Clean dial faces with tooth brush. When undamaged registers do not work freely, soak in pene-

trating oil or kerosene, then in very light lubricating oil. Make sure gaskets are completely removed, and clean chamber seat carefully. Some waters only discolor the chamber; do not remove this protective coating.

Acid cleaning, *if necessary*, should be handled with care. Bronze, brass, and rubber parts can be immersed in solution consisting of 50 per cent hydrochloric acid and 50 per cent water, each by volume. Immersion should generally not exceed ½ hour; cast iron parts not more than a few minutes. Rinse thoroughly with hot water and soda.

8. Coat packing washers with vaseline and assemble over stuffing box spindle. Screw on the clean stuffing box nut and make it finger tight; This should be enough to prevent leakage.

9. Examine measuring chamber for excessive wear, corrosion or distortion. Examine the disc piston closely for damage or distortion. A straight edge will show if the disc is warped. Examine half balls for swelling from hot water. Replace any badly worn or defective parts.

10. In assembling the piston in its chamber, insert the piston and thrust roller in the half of the chamber. Check clearances, and assemble thrust roller bearing plate if chamber is slotted for one.

11. Drop chamber into the inverted main casing. Bottom of chamber should come flush with gasket seat with thumb pressure.

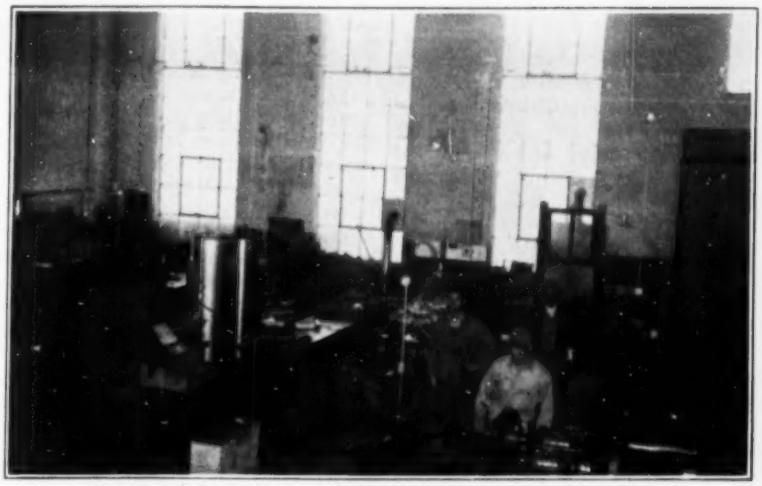
12. Gently blow into outlet port to test freedom of movement, again using a new meter as a guide.

13. Install the meter on test bench. Run water at full flow to clear out air. Check for leakages. Put on stuffing box change gear with same number of teeth as meter had when it came in.

14. Run a "full flow" test of 10 cu. ft. or 100 gallons. Registration should be between 98 and 100 per cent. If not, determine from the change gear chart the pair of gears which will give the desired result, install them and retest. Run a flow of 1 cu. ft. or 10 gal., first setting register to zero. Registration should be over 95 per cent. Run an intermediate flow test in the same manner; registration should be between 98 per cent and 102 per cent.

15. After the meter has passed all these tests, replace the register box and seal. It is now ready for accurate, dependable service.

16. If meter is not to be used immediately, store upside down, with tin caps or bungs on the spuds.



METER REPAIRS are made in Durham's Water Department Shop

### Suggestions

Scrap immediately any old parts found to be worn or damaged.

Never use repair parts other than those supplied by the manufacturer of the meter.

Do not use disc ball shims of absorbent materials. They will swell and cause trouble.

Never use emery cloth or paper for cleaning measuring chambers.

Seal meters following the O. K. test.

## Testing Large Meters

Following are the three best-known methods of testing meters:

1. By discharging water through the meter into a tank which rests on scales.

2. By discharging water through the meter into a tank which has previously been calibrated in cubic feet or gallons.

3. By testing the meter in the field with a previously calibrated meter.

As most water-works men are familiar with the first two methods, the author will confine himself to a description of the last method.

### Use of Calibrated Meter

Having a 4 in. compound meter with a 4 in. by-pass and proper valves, the meter-repair man can test and repair an installed meter without interference with the consumer's water supply.

In some cities, these by-passes are of the same size as the meter. That is to say, if there is a 4 in. supply line, the by-pass around the meter is also 4 in. This by-pass flow is controlled with a gate valve which is locked by means of a chain and padlock, the only key to which is held by the water department. In some cases, seals are used.

The test meter is attached directly to the installed meter with a 2½ in. hose. In some cases, a test tee is installed in the line between the outlet end of the meter and the gate valve. A 2 in. gate valve is attached to the meter below the hose connections; the advantage of this being that when making a test, the valve on the inlet side of the meter does not have to be shut off to make test connections.

If it is necessary to shut the valve to make test connections, the incrustation from the sides of the valve may be broken and lodge in the meter. This would require opening the meter and cleaning it before making a test, a necessity which in the case of a disputed bill would make the test almost worthless.

The type of meters which have been used for a good many years for making this test are a 3 in. velocity meter for the large flows, and a ¾ in. disc meter for the small flows. These two meters are connected to the meter to be tested using a 2½ in. high-pressure hose. The flows through the 3 in. meter are controlled by a 3 in. closing valve. The flows through the small meter are controlled by a ¾ in. angle valve on the side of the 3 in. meter to which is attached the 3 in. meter. When using a small meter, the 3 in. gate is closed, and vice versa. The 3 in. valve is a quick-closing valve. This enables the tester to close the meter more accurately than by a screw-stem valve.

The rate of flow is controlled by only partially opening the quick-opening valve. With a little experience, the tester can gage the flows very closely to the desired rates. Of course, he checks the flows with a stop-watch. As the pressure varies in different localities, the rate of flow does likewise.

### The Up-and-Down Test

In some cities, where large meters are tested at least once a year, the engineer in charge runs what is called an up-and-down test. This is performed by opening and closing the controlling valve slowly during the test so that the flow will vary from the minimum to the maximum rate of the test meter. This almost invariably not only covers the average rate of consumption, but the small night flow and the peak load.

In testing large meters with this apparatus, using from 15 to 20 feet of hose under 50 pounds per square inch pressure, one is able to test flows as large as 450 to 500 gpm., which in all ordinary cases is ample. For low flows, for which the ¾ in. or 1 in. meter is used, one is able to determine the minimum rate at which the meter to be tested is guaranteed.

In testing any type of compound meter, it has been our practice to test the smaller flow first, so that any error in the meter can be segregated. If on testing the by-pass meter, it is found to be in error, this error is corrected before running flows that are registered on both the main-line and by-pass meters.

We have no specified rates of flow at which we test meters in the field. Before making each test, the test meter is tested in our testing department.

### Meter Pits

A few words on a subject which is very closely related to testing: i. e., pits in which meters are set. I have seen meters set in pits so small that the top of the pit had to be removed before one could hook up the test apparatus.

In a number of cases, meters are set in pits so narrow that a man could not remove the meter bolts except with a socket wrench or hammer and chisel. While this is unavoidable in a good many cases owing to other underground conditions, I believe we would find the pits larger if the man in charge of building meter pits kept in mind the fact that the meter might eventually require repairs and that in all probability the work would be done in the pit. The box should be drained if possible. This will not only help the repair man, but also will assist in keeping the registers cleaner.

## 1691 Years of Service

Indianapolis Water Co.'s "Old Timers"

Fifty-four "Old Timer" employees of the Indianapolis Water Co. with a service record totaling 1691 years were recently honored at a meeting of the Company's Supervisor's Forum.

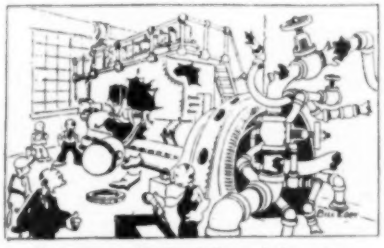
All men—plus 19 other men and women employees not in the above picture—have been recipients of the John N. Hurty Service Award which is presented by the Indiana State Board of Health to persons who have a record of 25 or more years of service in the water works field. The award was inaugurated in 1945 in honor of Dr. John N. Hurty, pioneer Hoosier health officer and crusader and the founder of the Indiana Water and Sewerage Association, the predecessor of the Indiana Section of the American Water Works Association.

Since its inception, a total of 103 Indianapolis Water Co. employees have received the Hurty award.

The seven men in the first row of the photograph have a combined service record of 304 years—an average of 43-plus years, with the center man (E. G. C. Summers) boasting 50 years. Names and positions of those with 35 or more years of service follow:

| Years | Name | Position |
|---|---|---|
| 50 | Ernest Summers | Yard Man |
| 46 | Norman Johnson | Janitor |
| 44 | Alva Payne | Asst. Supt. |
| 42 | George Rus | Chemical House |
| 42 | Joseph Turner | Helper |
| 41 | Edward McCreery | Chief Teller |
| 41 | Edward Clemons | Well Operator |
| 41 | Eugene Marshall | Caretaker |
| 40 | Grover Staley | Chief Clerk |
| 39 | Nathan Foreman | Laborer |
| 38 | Elmer Schwier | Controller |
| 38 | Charles Doane | Mechanic |
| 37 | Harvey Fagin | Meter Foreman |
| 37 | James Flippins | Laborer |
| 37 | Henry Boffis | Storeskeeper |
| 35 | Webb Comfort | Watch Engineer |
| 35 | Fred Armstrong | Watch Engineer |

Apparently the old gag about the first 50 years "being the hardest!" doesn't frighten employees of the Indianapolis Water Co. In the center, four rows back, is President Howard S. Morse, and Howard W. Niemeyer, superintendent of distribution, both being youngsters in terms of tenure of service amounting to 25 years or thereabouts.



"It's your wife, Boss! Says she's got a terrible headache."

# A.W.W.A. Technical Program

73rd Annual Convention, Grand Rapids, Mich., May 10-15, 1953

THE following program covering technical sessions of the forthcoming 73rd Annual Convention of the Am. Water Works Association has just been released. Although subject to minor changes, according to Secretary Jordan and Program Chairman Hazen, none of major proportions are anticipated.

## A.W.W.A. 1953 Conference
## Technical Sessions

*Monday, May 11—A.M.*

**Water Works Management Division**

9:30 Meeting the Needs of Fringe Developments — *Frederick Wegner*
10:15 Committee Report—Water Main Extensions — *L. S. Finch*
11:00 Management and Operation/Saginaw-Midland Supply Line — *Alfred Eckert*

*Monday, May 11—A.M.*

**Water Purification Division**

9:30 Activation of Silica — *C. A. Black*
Discussion — *A. E. Griffin*
10:15 Stationary Storage of Liquid Chlorine — *A. S. Woodard, L. L. Hedgepeth*
11:00 Application of the Micro-Strainer to Water Treatment in England — *Richard Hazen*
*H. P. Boncher*
Discussion — *A. A. Kalinske, A. W. Consoer*

*Monday, May 11—P.M.*

**Joint Open Session—Correlating Committees**

2:00 Water Works Administration
3:15 Water Works Practice
(A review and discussion of current activities)

*Monday, May 11—P.M.*

**Water Purification Division**

2:00 Committee Reports
4:00 Business Meeting

*Tuesday, May 12—A.M.*

**Water Works Management Division**

9:30 Committee Report—Water Use in Air Conditioning — *Frank C. Amsbary*
10:15 Committee Report—Water Rates — *Lewis E. Ayres*
11:00 Promoting Better Public Understanding of What Water Works Service Is Worth — *M. B. Cunningham, W. V. Weir, L. R. Howson, J. H. Murdoch, S. B. Morris*

*Tuesday, May 12—A.M.*

**Water Purification Division**

9:30 Do We Need a New Water Quality Yardstick? — *W. A. Mallmann*
Discussion — *F. W. Gilcreas*
10:15 Water Borne Outbreaks—A Statistical Study — *Abel Wolman, William T. Ingram, A. E. Gorman*
11:00 Panel Discussion: — *Moderator Merrill Riehl*
Lime Softened Water—Effects on Bacteriological Quality — *H. O. Hartung*
Main Disinfection — *Paul C. Laux*
Zinc Bearing Metals — *Walter Muhlitner, Frank S. Taylor*

*Tuesday, May 12—P.M.*

**Transmission and Distribution Division**

The New Standards for Cast Iron Pipe
2:00 Their Development — *Thomas H. Wiggin*
2:30 Resulting Changes in Production Methods — *Thompson Vann, H. W. Stuart*
2:50 A Consulting Engineer's Appraisal — *L. R. Howson*
3:10 Management's Appraisal — *W. R. LaDue*
3:30 Studies on the Mechanism of Corrosion — *James Lamb III, Rolf Eliassen*
4:00 Cast Iron Pipe Coatings as Related to Corrosion — *John R. Baylis*

*Tuesday, May 12—P.M.*

**Water Works Management Division**

2:00 The 1952 Drought in the Southwest—Its Supply and Public Relations Problems — *Marvin Nichols*
2:45 A Safety Program for the Water Works Industry
Introduction — *R. J. Faust*
Supply — *Jerome Powers*
Treatment and Pumping — *Oscar Gullans*
Distribution — *Kenneth A. Day*
Administration — *Rodney A. Edwards*

*Wednesday, May 13—A.M.*

**Water Resources Division**

9:30 Predicting Fluctuations in the Michigan Huron Lake System — *John E. Vogt, Donald Pierce*
10:00 Developing and Controlling Kansas' Rivers An Engineering Analysis and Report — *N. T. Veatch, L. R. Howson, Abel Wolman*
11:00 Managing the Missouri River Projects — *Dale Maffitt*

*Wednesday, May 13—A.M.*

**Transmission and Distribution Division**

9:30 Motor Drives for Water Pumping — *E. O. Potthoff, M. C. Boggio*
10:00 Application of Vertical Pumps to Water Works Practice — *Thomas N. Niles*
10:30 Control of Water Pressure on Suburban Distribution Lines — *J. S. Williams*
Discussion — *L. S. Finch*
11:15 Progress Report—Committee on Water Hammer — *S. Logan Kerr, Hugh Kennison*

*Wednesday, May 13—P.M.*

**General Session**

2:00 Panel Discussion: The Highway Improvement Problem. Participants to be selected upon basis of developments during next 30 days.
2:45 What M.S.A. Means to the Water Supply Industry — *W. F. Rockwell*
3:15 Task Group Report—Training Water Works Personnel—Schools and Conferences
*R. J. Faust, Chairman, E. S. Hopkins, F. Merryfield, A. P. Black, E. R. Stapley.*

*Wednesday, May 13—P.M.*

**Closed Session**

2:00 Water Works Administration Committee
Water Works Practice Committee

*Thursday, May 14—A.M.*

**Water Resources Division**

9:30 Committee Report—Ground Water Pollution Control — *Norman F. Billings*
10:00 Committee Report—Erosion Control on Reservoir Areas — *B. S. Grant*
10:30 Water Conservation Methods Used in Industry — *H. E. Hudson*
11:00 Interpretation of Pumping Test Data for Wells — *Russell H. Brown*

*(Continued on next page)*

*Thursday, May 14—A.M.*

**Transmission and Distribution Division**

9:30 Design, Construction and Functional Relationships of New Wanaque Supply Line — *C. H. Capen*

10:15 Design of Wye-Branch Fittings — *H. J. Chapton, H. S. Swanson, Carlton L. King, W. J. Wilkinson*

11:00 Panel Discussion: Plastic Service Pipe — *James Carns, Max Socha, W. D. Tiedeman*

*Thursday, May 14—P.M.*

**Joint Session—Water Resources and Water Purification Divisions**

2:00 Effect of Irrigation Run-off on Surface Water Supplies
Introduction — *M. B. Cunningham*
Discussion — *C. S. Howard, Paul D. Haney, J. K. Silvey, A. A. Bendixon*

3:00 Controlling Industrial Pollution of the Passaic River — *Frank DeHooge*

3:45 The Effects of Synthetic Detergent Pollution on the Operation of the Ossawatomie, Kansas Water Softening Plant — *Russell L. Culp, Howard Stoltenberg*

*Friday, May 15—A.M.*

**General Session re Fluoridation**

9:30 An Evaluation of Fluorides in North Dakota Water Supplies — *A. E. Williamson, J. H. Svore*

10:00 Defluoridation of Municipal Water Supplies — *F. J. Maier*

10:30 A Rational Approach to Fluoridation — *J. E. McKee*

11:00 How a Health Commissioner Looks at Fluoridation — *A. E. Heustis, M.D.*

11:30 General Discussion

# Quick—the Chlorine Dioxide

## An Open Letter From One "Super" to Another

**Dear "Bill"—**

You remember my telling you at the last Water Works Conference of the results of our lab tests on the use of chlorine dioxide. We next got in a supply of sodium chlorite and decided to run a plant test. Up to that time we hadn't decided how to feed the darn stuff.

At the conference, we talked with manufacturer's representatives and they offered to loan us the equipment. When I took it up with my boss, I found that for us a loan was against the law. We must be obligated in no way. Neither were there any funds to rent or buy equipment. My budget had been cut and it was necessary to get by on what I had.

### The Problem

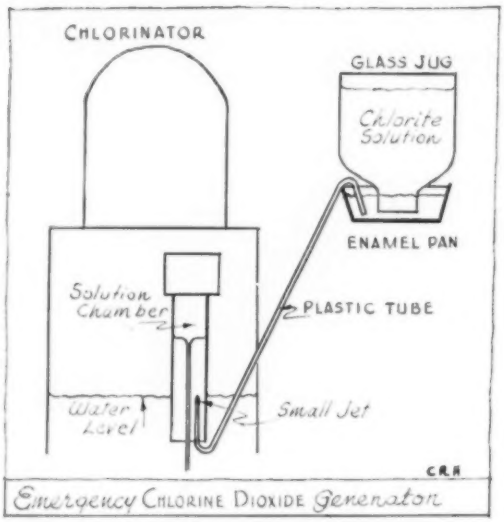
I was sure that the use of chlorine dioxide would save us money and at the same time correct our manganese problem, so I rolled a cigarette and sat down to dream. The problem was to feed the chlorite solution to the chlorine solution from the chlorine machine; mix them thoroughly, and then convey the resulting mixture to the water to be treated. Chlorine dioxide is a powerful oxidizing agent. It must be prepared and used in very dilute solution; they say that dry chlorine dioxide *gas* is explosive when concentrated.

### The Solution

As our water flow is constant when the treatment plant operates, I could feed the chlorite solution at a constant rate. This part was simple: I filled a five gallon glass jug with sodium chlorite solution and upended it in a two quart enamel pan. Now I had a constant level reservoir (to tell the truth, it's exactly like a self-watering chicken pail), which I set on a shelf level with the bell jar of our chlorinator.

To feed the sodium chlorite solution at a constant low rate, I made a siphon from two short pieces of glass tubing and a 3-ft. length of plastic tube. The ends of a broken pipette supplied the glass tubing—I heated each piece in a gas flame and made a right angle bend. The tip end from the pipette gave me a small jet to restrict the siphon flow.

Now you will see in the sketch how I set up this arrangement. The higher end of the siphon was hooked




over the edge of the enamel pan, and the lower end was run under the solution tube of the chlorinator. Once the siphon was started (simply by filling the plastic tube with water), the constant head gave me a constant delivery of the chlorite solution.

When I went out and looked at the solution discharged from the chlorinator hose, the golden yellow color and the odor of the solution told me I had what I wanted! The mixture of sodium chlorite and chlorine solutions gave me the solution of chlorine dioxide. To vary the dosage of chlorine dioxide, all I need to do is change the strength of sodium chlorite solution.

Yours,

**"Ray"**

[Ed. Note: "Ray" is actually C. R. Harlock, Supt., Eden Creek Filtration Plant, McNeil Island, Wash. The plant scale use of the emergency chlorine dioxide generator, and the results obtained, have been described in the February, 1952, issue of *Water & Sewage Works:* "Chlorine and Chlorine Dioxide for Control of Algae Odors" by Messrs. Harlock and Dowlin.]

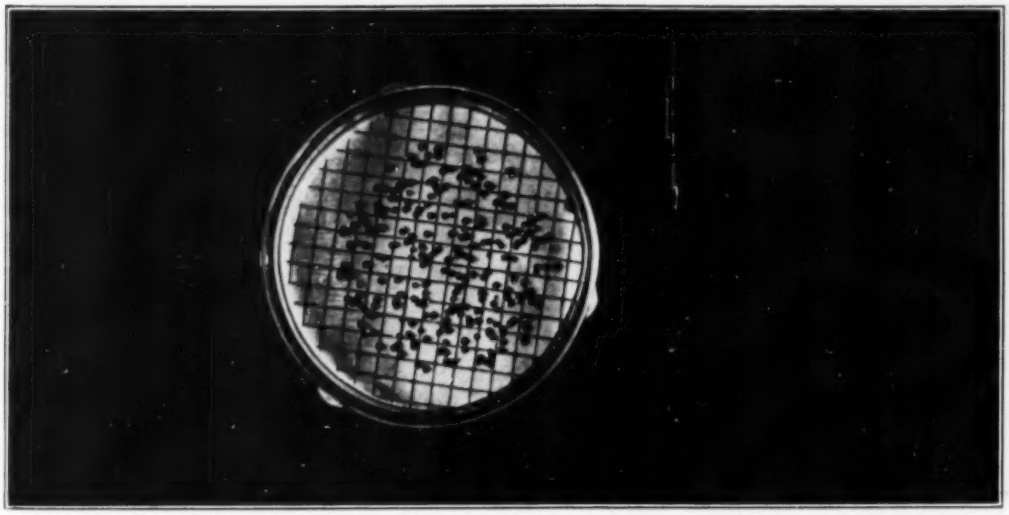


Fig. 1—MILLIPORE FILTER showing colonies of *Serratia marcescens* cultured on the MF surface

# New Bacteriological Technique for Testing Water and Sewage

## A Description of the MF Millipore Filters —Their Characteristics and Applications

*by* JOHN H. BUSH, *Lovell Chemical Co., Watertown, Mass.*

FOR the first time in many years a completely new bacteriological technique has been developed. The basis of this method is a unique filtering material, termed the MF Millipore Filter, now in commercial production. It provides a new tool for the sanitarian to utilize for determining the bacterial content of water and sewage—more rapidly and more accurately than has ever before been possible.

The MF Millipore Filter is an outgrowth of what certain authors[1, 2] term the "molecular filter," and what others[3, 4] describe as the "membrane filter." For information regarding the historical development of this filtering medium, reference is made to the appended list of reference articles. The Environmental Health Center of the U.S.P.H.S. and the Standard Methods Committee of the A.P.H.A. are presently engaged in a program of study of the application of the MF Millipore Filter to the bacteriological analysis of water. The procedures are outlined in an illustrated booklet which may be obtained from the manufacturer of the filters[5].

### Characteristics of the Millipore Filter

The physical nature of the MF is truly unique and must not be thought of in terms of conventional fibrous filters, such as filter papers composed of cellulose fibers. The novelty of this thin (150 micra) sheet is perhaps best described in terms of its function. The new filter material quantitatively concentrates on its very surface bacteria suspended in a liquid medium (HA, Hydrosol Assay Type) or gaseous medium (AA, Aerosol Assay Type). Although it in no way resembles it in appearance, the filter may be likened to a hypothetical screen composed of wires of infinitely small diameter, the pores or openings of which are uniformly of a size in the sub-micron or microscopic range.

The actual structure is probably more closely simulated by an arrangement of uniform hexagonal capillaries perpendicular to the surface of the filter, the intercellular walls representing only 18 percent of the volume of the thin sheet. Thus we have a "separatary screen" effective in the sub-micron range in particle size (composed of 82 percent space of voids) only 18 percent of which is occupied by the delicate structure forming the uniform pores.

The application of the MF in bacteriological techniques involves two factors: first, an improved method of filtra-

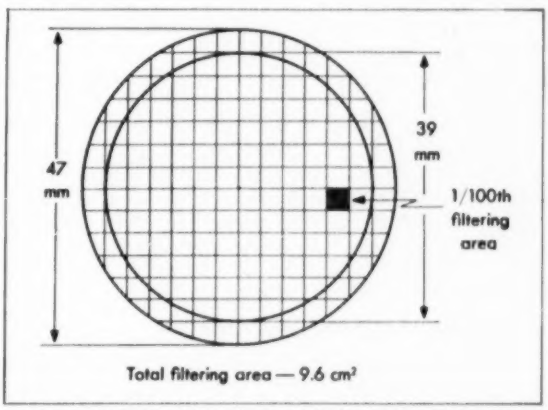



Fig. 2—MF filter disc. The imprinted grid subdivides the filtering area, each square representing 1/100th of the total

Fig. 3—DPD disposable petri dish with rim-mounted Millipore Filter and adsorbent pad

tion, through its ability to concentrate bacteria quantitatively on a plane; and second, the resulting facility to culture, identify, and count bacteria retained on this plane. The necessary liquid nutrients are supplied by capillary action from the bottom surface of the filter to the retained bacteria on its top surface (see Fig. 1).

In summary, then, these several properties suggest basic applications of the new porous material:

1. It achieves filtration of microscopic and submicroscopic particles as a surface phenomenon, or a screening action, in which retention is defined by pores of controlled size.

2. It approaches optimum efficiency as a filter in terms of retention and resistance to flow, the volume of the filter being only 18 percent structure or substance.

3. It provides a porous matrix, which is virtually a plane surface, on which to culture microorganisms.

The HA filter, developed for the quantitative surface retention of bacteria suspended in liquids (determined as a control with *Serratia marcescens*), has a flow rate of approximately 72 ml. of distilled water at 21°C per square cm per minute at a differential in pressure of 70 cm of mercury. The filters are supplied in discs 47 mm in diameter with an effective filtering area of 9.6 square cm. To facilitate total count approximations, a grid imprinted on the surface of the filter disc subdivides the area of the disc so that each square represents 1/100th of the effective filtering area of the disc (*see Fig. 2*) when used with standard apparatus.

### Application of the Millipore Filter

The present standard method for the estimation of the total bacterial count in water is limited in many ways for a number of reasons: (1) only a small amount of sample can be used for each test; (2) large amounts of materials are involved in the procedures; (3) time, labor, and cost are other factors which hinder the prompt and efficient determination of pollution of water. The adoption of the MF technique for the quantitative bacteriological examination of water and sewage can decrease materially the cost, time, labor, and space required for these tests. The new technique may also increase accuracy and results which would have required several days may be obtained in a matter of hours.

### Culture Media

The following outline of procedures will indicate very briefly the simplicity of the MF methods. Further details may be found in reference articles[6, 7].

Liquid media are required in order to diffuse through the filter membrane and support bacterial growth. It is recommended that nutrient broth media should be of double or triple strength.

The medium found by Kabler and Clark[6] to be satisfactory for the determination of total bacterial count is as follows:

| | |
|---|---|
| Peptone "M" (Albimi) | 40 gms. |
| Yeast Autolysate (Albimi) | 6 gms. |
| Sodium Chloride | 2.5 gms. |
| Lactose | 5 gms. |
| Distilled Water | 1,000 ml. |

The media are adjusted before sterilization to a pH of 7.0.

The Millipore Filters may be sterilized by autoclaving. It is, however, essential that they be packed with absorbent pads at the top and bottom of a pile of filter discs, the whole being wrapped in kraft paper.

### Plastic Disposable Petri Dish

The plastic disposable Petri dish (DPD) has been developed as a simple and convenient container for the incubation of bacteria on the MF surface. Incubation is best accomplished in an atmosphere saturated by water vapor and, in this tightly sealed container, adequate water vapor is provided by the liquid nutrient in an adsorbent pad.

The plastic material has a low thermal conductivity and this tends to reduce internal condensation and to stabilize the temperature. It is also significant, when dealing with hyper-sensitive organisms, that the plastic is an effective barrier to ultra-violet light in the range of 500 A to 3000 A, which is not the case with glass. In handling highly pathogenic organisms the DPD tends to eliminate danger of contamination by the hermetic seal between top and bottom accomplished by the Johanson Effect (swedging).

Fig. 3 shows the disposable Petri dish with the MF and adsorbent (nutrient) pad. The plastic dish may be sterilized in a number of ways for re-use: with various chemicals such as chlorine or alcohol, or with ethylene oxide. Other equipment, including the stainless steel hydrosol unit (Fig. 4) and the Pyrex filter holder (Fig. 5) may be sterilized by autoclaving.

### Water Examination Using the MF Filter

The procedure involved in water examination with the MF filter may be briefly summarized as follows:

1. Attach the filter holder, using a rubber stopper, to a vacuum flask and connect to a vacuum line.

2. Place the sterile filter disc (grid-side up) on the base of the filter unit, using sterile flat bladed forceps. The filter holder provides a means of adequately supporting the filter discs without creating undue stresses.

Fig. 4—STAINLESS STEEL hydrosol unit

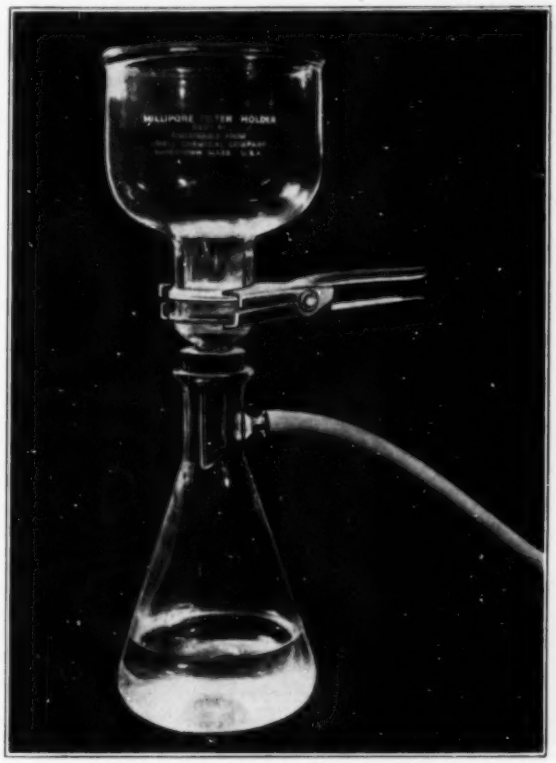


Fig. 5—PYREX holder for Millipore Filters

3. Filter the sample through the Millipore Filter and, leaving the disc in place, wash the sides of the funnel with approximately 50 ml of sterile distilled water. The filter assembly should be wrapped in kraft paper and autoclaved at the end of each day.

4. Place an amount of sterile broth, sufficient to saturate the adsorbent pad, in the bottom of a sterile DPD and place a sterile adsorbent pad in the dish.

5. After filtration, remove the filter disc with sterile flat-bladed forceps and place it on the adsorbent (nutrient) pad.

6. Incubate at 35° to 38° C for 6 to 24 hours. For most laboratories an incubation period of 16-18 hours is recommended unless it is desirable to obtain the results of the analysis at an earlier time.

7. After incubation the colonies are counted with the aid of low power (15 x) magnification. Isolated colonies may be transferred to other media for further study if desired.

The use of differential media with the MF yields very satisfactory identification of coliform and pathogenic organisms. Several of these techniques have been reported in studies of the U.S. Public Health Service.

## Advantages of the New Technique

Outstanding advantages of the new technique appear to be that an accurate quantitative examination for coliform organisms in a water sample may be made in 18 to 20 hours. By using differential media, a direct count of coliforms may be obtained rather than the MPN. (most probable number).

This technique facilitates a rapid and more sensitive method for the detection of pathogens in water; colonies can be detectted as quickly as four hours after incubation. The method increases by a factor of 30 to 50 times the number of colonies which can be counted from a single dilution. Much larger volumes of sample may be examined, thereby increasing the precision.

It is possible, at any time during the growth cycle, to transfer the growing organisms from one or more enrichment media to special differential media. The MF provides a convenient and accurate means of taking bacteriological samples in the field. The adaption of this technique may materially reduce the cost of bacteriological examination.

## Summary

The MF Millipore Filters will enable the bacteriologist in the water laboratory to make a more accurate analysis, and obtain the results in a very much shorter time. This alone would characterize the MF as being a basic and highly significant development. The saving in cost is an unexpected and important element. The technique will facilitate the extension of control of water supplies to rural areas that are not adequately covered at the present time.

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1. Goetz, A., and Tsuneishi, N. Application of Molecular Filter Membranes to the Bacteriological Analysis of Water, Jour. Am. Water Works Assoc., Vol. 43:943 (1951)

2. Goetz, A. Fiat final report 1312, Joint Intelligence Objectives Agency, U.S. Department of Commerce, Washington, D.C. (1947)

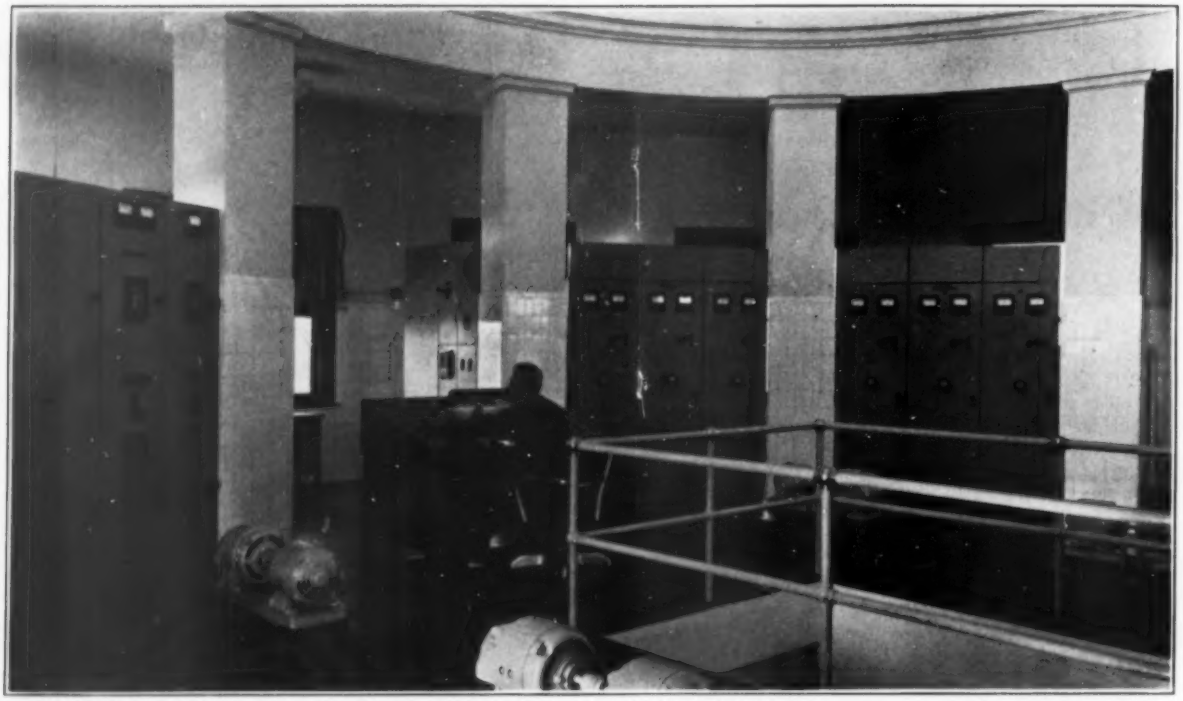
3. Clark, Harold F.; Geldreich, Edwin E.; Jeter, Harold L.; and Kabler, Paul W. The Membrane Filter in Sanitary Bacteriology, Pub. Health Rpts., 66:951 (1951)

4. Clark, Harold F., and Kabler, Paul W. The Membrane Filter in Water Quality Tests, Am. Jour. Pub. Health, 42:930 April 1952

5. Characteristics and Uses of the MF Millipore Filters. Lovell Chemical Co., Watertown 72, Mass.

6. Kabler, Paul W.; Clark, Harold F. The Uses of Differential Media with the Membrane Filter, Am. Jour. Pub. Health, 42:390 April 1952

7. Geldreich, Edwin E.; Jeter, Harold L. Evaluation of Differential Media on the Membrane Filter, Soc. A, Bact. 52nd General Meeting, Boston, Mass., April 27, 1952 to May 1, 1952



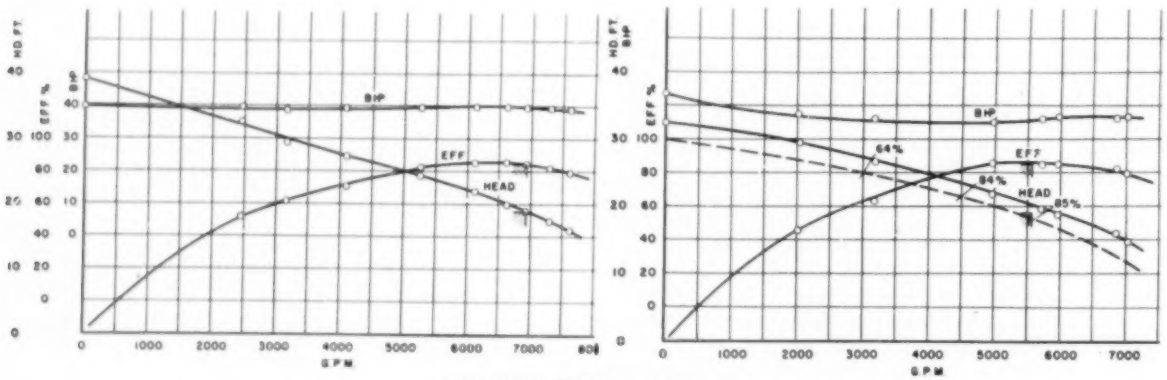
MASTER CONTROL desk and main panel board. In location of old vertical drive motors are mounted the remote motor driven exciters for synchronous pump motors in dry well below.

# New Equipment Lowers Pumping Costs at Trenton's Sewage Treatment Plant

*by* EDWARD C. CONDICT, *Application Engineer, De Laval Steam Turbine Co., Trenton, N.J.*

IN 1949, the City of Trenton, N. J., installed six new synchronous motor driven centrifugal pumps at its 25 year old sewage treatment plant, changed the electrical distribution system and modernized the flow recording instruments. The gratifying results have been lowered pumping costs, fewer shutdowns, reduced maintenance and increased accuracy of the records kept. The savings on electric power alone have amounted to more than $3600 annually when pumping sewage flows averaging 18.5 MGD.

A circular building, 54 feet in diameter houses the pumping equipment. The pump floor is in a dry pit thirty feet in diameter and thirty feet below ground level, entirely surrounded by an eight foot suction well. Raw sewage passes through bar screens having 1" spacing and a 60' grit chamber where the average velocity is held to one foot per second. The pumps discharge vertically into a force main, 16½ feet above the




EFFICIENCY TEST curves for pumps.
Fig. 1 (left) for 10 mgd. pumps. Fig. 2 (right) for 8 mgd. pumps.

pumps. This main is 54" in diameter where it passes through the building to the Imhoff tanks. A simplex venturi meter in this line measures the flow being pumped.

### The Original 1927 Installation

Originally six De Laval vertical 20" double suction pumps were installed when the sewage treatment plant was built a quarter century ago in 1927. Three variable speed pumps driven by slip ring motors had a capacity of 11 MGD each, while the three constant speed pumps with squirrel cage motors were 8 MGD each. All operated against a total dynamic head of 23'. Automatic controls on the variable speed units changed the speed so that any delivery between 3 and 11 MGD could be obtained. When the 11 MGD capacity was reached, red lights showed and a bell sounded to warn the operator to throw in an 8 MGD constant speed unit. The speed of the variable speed pump would again change automatically as the station flow increased another 11 MGD, reversing the cycle when the flow decreased. This operation might therefore be termed semi-automatic, as the operator could choose the pumps to be used, and the controls took care of the change of flows within the limits of the units being operated.

The automatic controls were abandoned after a year's trial. It was found that full manual operation saved about 50 cents in electrical charges per million gallons pumped without affecting the efficiency of the Imhoff tanks receiving the pumped sewage. Operators had to be on duty 24 hours a day and the additional work done was negligible. Another factor of importance was high maintenance costs for the complicated automatic switching devices.

Maintenance of the pumps over the following 23 years consisted mainly in replacing shaft sleeves, case and impeller wearing rings every four or five years. During this period the impeller of each pump had to be replaced only once. These measures kept pump efficiencies at a peak level until 1948 when a series of tests and measurements showed that the pump casings were so badly worn that replacement was necessary.

Accordingly plans and specifications were prepared by P. N. Daniels, engineer in charge of the Trenton plant, with the cooperation of the Simplex Valve and Meter Co., Westinghouse Electric Co., and the De Laval Steam Turbine Co. A complete new installation of pumps, motors, control centers, transformers and miscellaneous appurtenances was decided upon. Nothing but a portion of the main discharge manifold was to be used. Even the operating voltage was changed from 2300V to 440V.

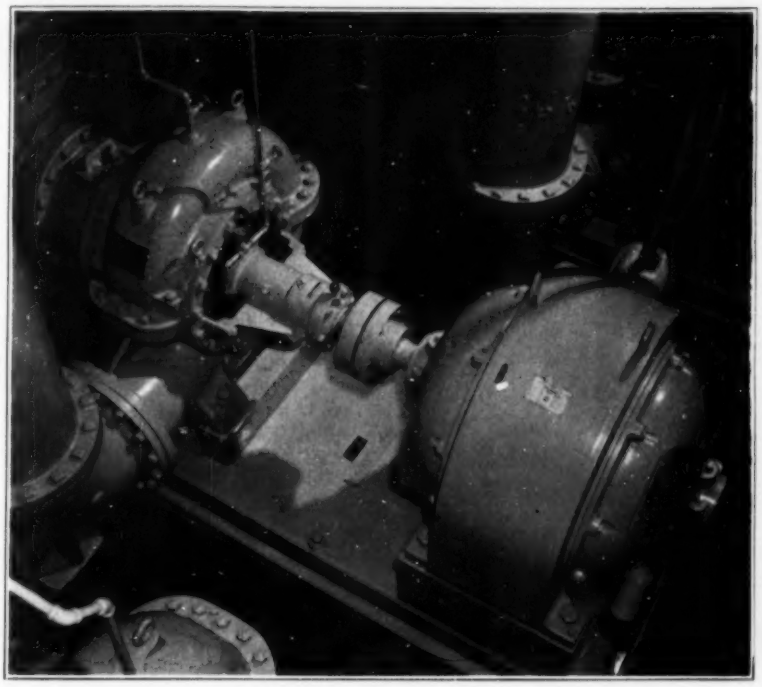


Fig. 3—CLOSE VIEW of one of the six new pumps.

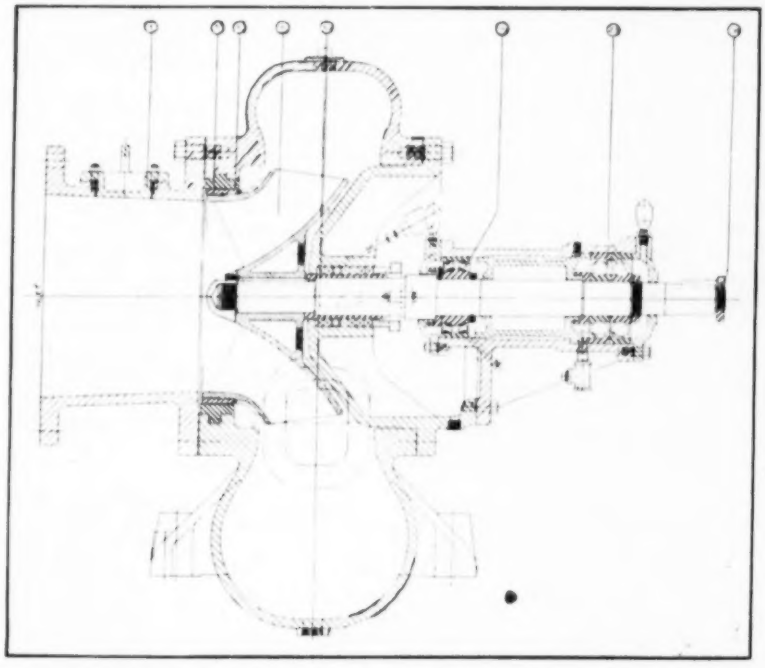


Fig. 4—ASSEMBLY drawing showing features of the De Laval Sewage Pumps installed.

*(1)—Hand-hole cover. (5)—Impeller wearing ring. (6)—Case wearing ring. (8)—Impeller. (10)—Shaft sleeves of stainless steel. (18)—Anti-friction radial thrust bearings. (23)—Double row of ball thrust bearings. (28)—Nut securing coupling on tapered shaft.*

*NOTE*—R. A. McQuade of the Simplex Valve & Meter Co. furnished information covering the hydraulic recording instruments, while R. R. Nissley of the Westinghouse Electric Co. furnished information covering the electrical equipment.—*The Author.*

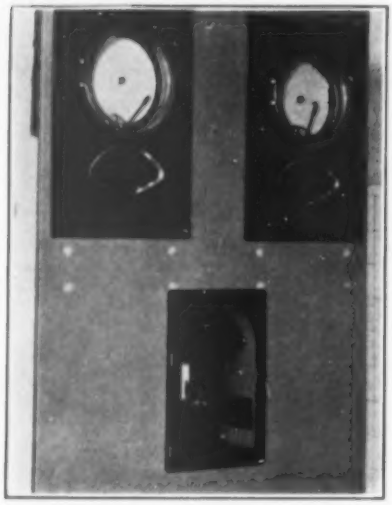


Fig. 5—SIMPLEX type "MO" indicating, recording and totalizing instruments for pumping rates and liquid levels.

### Pumps Selected

Six De Laval mixed-flow pumps were purchased. All have 16" suction and discharge openings. Three are 10 MGD pumps and three are 8 MGD units, each operating at 600 RPM against a total dynamic head of 19 feet. Figs. 1 and 2 show the test results of the 8 and 10 MGD pumps. The 8 MGD units may be increased to 10 MGD units in the future if the need arises. These are horizontal units, eliminating the vertical shafting which had caused maintenance problems. Synchronous motors improve the electrical characteristics. Lack of space did not permit the excitors to be mounted on the end of the motors in the usual manner, so motor driven excitors were installed on the ground-level floor in the space originally occupied by the vertical motors. (See header picture.)

The De Laval mixed-flow type pump installed (Fig. 3) is of the end suction design, discharging vertically. Fig. 4 is an assembly drawing of the pump. This drawing and photograph reveals that the case is split horizontally, making it possible to remove the top half without disturbing the piping connections. The cover is provided with two handholes, one in the suction nozzle and the other in the volute. This permits easy access to the impeller in case of clogging. A three vane, non-clogging bronze impeller is used that can pass solids 4 inches in diameter. Removable stainless steel case rings, impeller rings and shaft sleeves are used. The impeller rings and shaft sleeves are secured to prevent unscrewing when the pump rotates backwards during periods of backwashing.

### Dismantling and Installation Problems

Removing the old pumps and installing the new ones presented many problems. The entire contract had to be completed within 365 days. Furthermore, the State Board of Health would not permit a plant shutdown of more than five successive days, with a minimum of seven days between shutdowns. During these times at least four pumps had to be kept available for pumping sewage.

As it was not possible to drain the suction well completely, the pump floor was flooded whenever the wall was broken through to insert the new suction lines, a situation not conducive to pleasant working conditions.

The discharge piping from the pumps had to be rearranged. This meant supporting the 54" force main, into which the pumps discharged, in such a manner that the old pumps could be lifted out and the new ones lowered without interfering with the temporary supports.

The old pumps were driven by 2300 volt motors, while the new ones have 440 volt motors. Therefore, during the changeover period both types of current had to be supplied at the same time from a 4160V source. Likewise, it meant new control panels; and, to add to the difficulties, the new control panels had to occupy the same space used by the old ones.

Six 50 horsepower 440 volt synchronous motors comprise the main load on the distribution system. 440 volt motors and controls were selected because they are safer and more economical.

The incoming service consists of two 4160 volt, 3-phase, 4 wire lines from the utility company. One incoming line is the normal feed, the other an emergency feed. There is no necessity for automatic transfer from one incoming line to the other, which makes the switch gear less expensive.

### Electrical Equipment

The high voltage switchgear is of the Westinghouse Metal Clad draw out type Air Circuit Breakers, consisting of: two dummy breaker cells, one drawout dummy unit being used as selector switches for the two incoming lines, a main breaker, a metering unit and two feeder breakers. All breakers are rated at 5000 volts, and 50,000 KVA interrupting capacity.

The dummy breaker unit can be transferred from Unit No. 1 to Unit

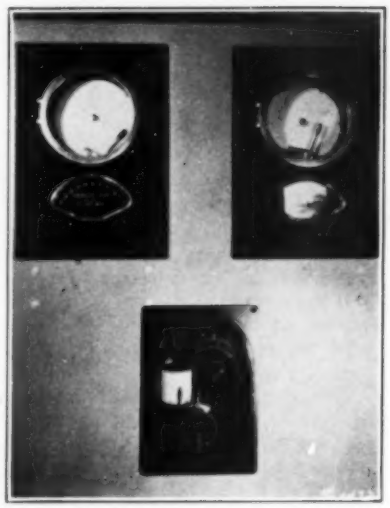


Fig. 6—OLD PANEL after modernization and installation of additional liquid level gauge for conduit level.

No. 2 and performs the same function as a double throw-no-load break switch by transferring the load to either of the two incoming power lines. The dummy breaker, being a no-load break switch, is interlocked with the main breaker so that the breaker must be open before the dummy breaker unit can be removed from the cell, and the dummy unit must be in one or the other cell before the main breaker can be reclosed. The advantage of using dummy breakers instead of a transfer switch is that high voltage metal clad switchgear has insulated bus and connections, and by using dummy breakers this insulation can be carried through the entire switchgear. When disconnect switches are used there is no way of insulating the stationary jaws or the blade of the switch; therefore, a more reliable set of switchgear is obtained when using dummy breakers.

Lack of room made it necessary to locate the original high voltage switchgear and several contactor panels one floor below the operating floor. The main panel board on the operating floor mounted various motor and distribution controls, including switches, motors and auxiliary motors. (See header picture.)

The circular type of building design presented quite a problem since the new metal clad switchgear fits between building columns and at the same time curves to follow the contour of the wall. The high voltage metal clad switchgear is built in sections, and a special design bus duct located behind the columns connects the buses of the two sections.

A bank of three 100 KVA Oil In-

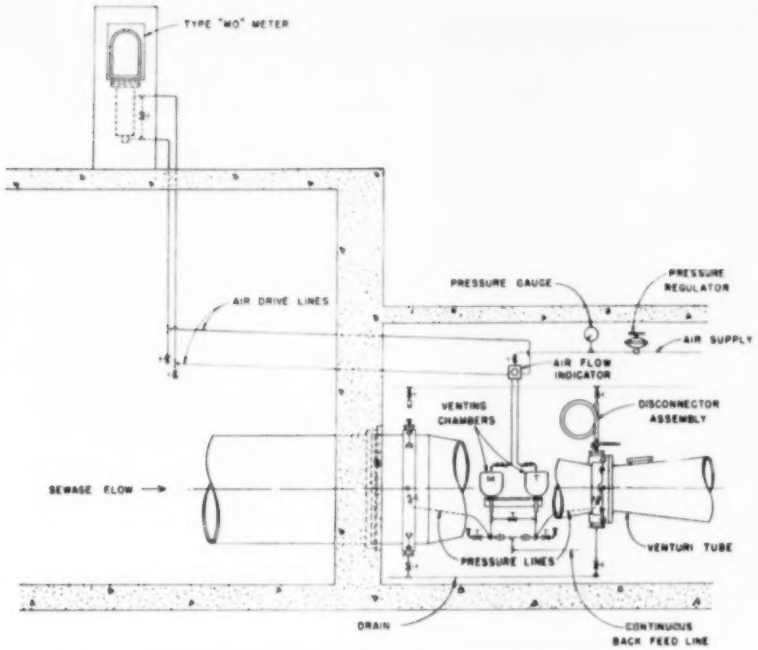



Fig. 7—ILLUSTRATIVE of method of employing air for transmitting meter conditions to instruments remotely located.

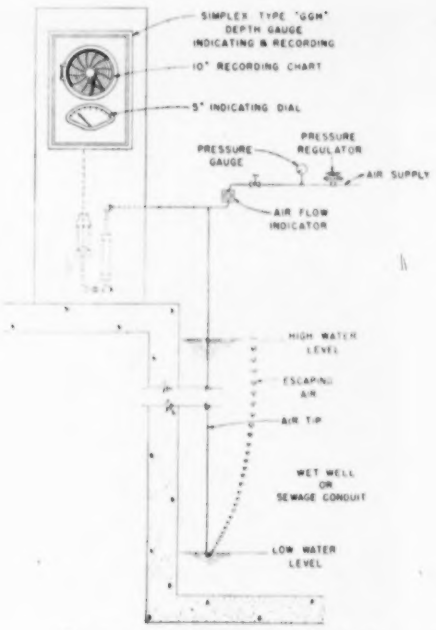



Fig. 8—ILLUSTRATIVE of method of employing air for transmitting liquid levels to instruments.

sulated self-cooled 4160 to 440 volt transformers are installed on a pad outside the building with the low voltage feeding into a low voltage distribution panel. From this panel a feed runs to the six motor starters through conduit formed to follow the outline of the archway between the distribution panel and the motor control units. The six motor control units are supplied in two groups of three each so fitted between the columns that they follow the circular confine of the building. The buses of the two groups of motor control are connected with cable in conduit.

Other breakers in the distribution panel provide centralized feeder protection to miscellaneous circuits, including two circuits to dry type 440 volt to 110-220 volt lighting transformers. Depth gauges, Venturi meters and contactors for solenoid valves are mounted in appropriate enclosures.

### Master Visual Control Desk

A master control desk mounted as shown in header picture provides for complete operation of the pump motors and solenoid valves. Ammeters mounted on this desk give the operator the load for each pump motor, while indicating lights show which motors are in operation, and lights are provided for screen water level warning signals.

Revamping of the electrical equipment has contributed to the savings mentioned in this article. In addition, the electrical equipment is modern and safer to operate, with adequate capacity and provisions for future expansion. Mounting the electrical equipment on the main floor in sight of the operator gives him complete control of all the apparatus, resulting in a more efficient operation of the entire sewage pumping station.

### Venturi Meter, and Appurtenances

When the pumping station equipment was to be renovated it was decided to use the existing Venturi tube, but replacing the old indicating and recording instrument with one of the latest models designed for air operation. The Simplex Venturi meter installed originally in 1927 consisted of a 54″ x 24″ sewage type Venturi tube with its accompanying indicating, recording and totalizing instruments.

The tube itself merits some comment since it is of the concentric design having a cast iron upstream section with its inlet end in the form of a spigot, designed for caulking into a wall casting. Attached to the throat flange is a 24″ diameter spool piece about three feet long which is designed to terminate in a wall and from which the remainder of the downstream section is constructed as a tapered concrete form until the full 54″ diameter again is reached. This Venturi tube is provided with the standard form of bronze throat liner and bronze bushed piezometer taps and hand operated cleaning valves at the main and the throat sections.

Despite its age it was considered that the Venturi tube was in sufficiently good condition to provide many more years of service and that the logical procedure would be to install a new air operated indicating and recording instrument to work in conjunction with it. Consequently, there was furnished a Simplex type "MO" indicating, recording and totalizing meter arranged for instrument panel mounting as illustrated in Fig. 5. This meter is of the air operated type whereby the liquid differential pressures created at the Venturi tube are transferred to and exerted upon the mercury within the meter cylinder through the medium of balanced air differential pressures.

To accomplish this only a slight change of piping at the tube itself plus the addition of a small pressure regulator, pressure gauge, air manifold and two air venting chambers, together with ¼″ copper tubing, was required.

The revamped Venturi meter is capable of measuring and recording a maximum of 50.5 MGD and a minimum of 2.525 MGD with an average error not exceeding plus or minus 2% at any point over this range. Thus extreme accuracy of measurement is obtained, regardless of the flow condition existing at any time.

### Wet-Well Gauges Modernized

At the same time it was decided to modernize the existing Simplex wet-

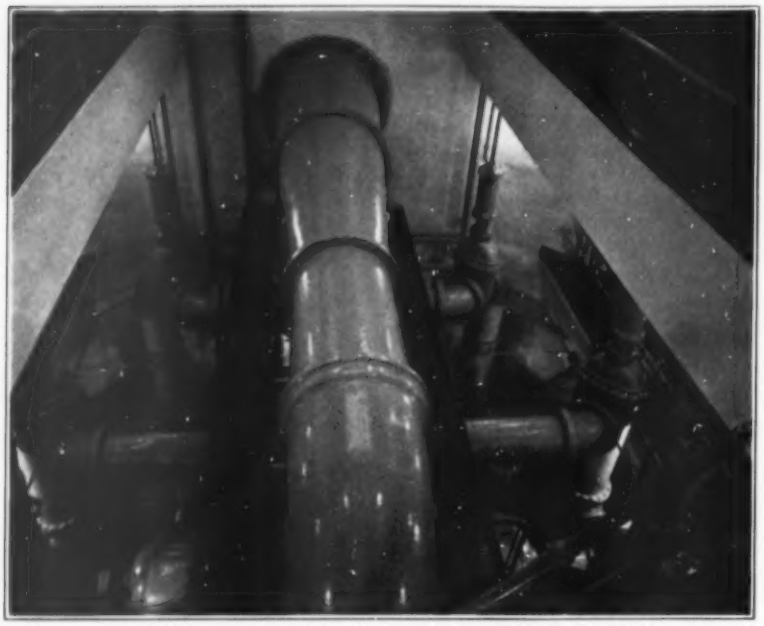


Fig. 9—PUMP WELL showing piping arrangement and revealing limited space into which the six pumps had to be fitted.

well level gauge and to furnish a new gauge for measuring the level of sewage in the conduit. An installation view is shown in Figure 6 which illustrates how these gauges are arranged for panel mounting and how a symmetrical appearance is obtained when properly spacing these with the panel mounted meter.

The existing gauge showing the sewage level in the wet well was renovated and equipped with charts and dials to read from 45 feet to 55 feet elevation, or a total range of 10 feet. The new gauge has charts and dials to read the sewage conduit levels between 50 feet and 60 feet, or a total range of 10 feet.

Both of these gauges are of the air operated type, the movement of the indicator pointer and the chart pen being effected by air pressures balanced against the depths of liquid existing in the wet well and conduit respectively. Included with each gauge is a specially designed mercury U tube together with pressure regulator, small pressure gauge, air flow indicator, air tip and the necessary ¼" O.D. copper tubing.

Figure 7 is a schematic diagram showing the method of installing and operating the air operated Venturi meter instruments while Figure 8 is a similar diagram showing the layout of the air operated liquid level gauges.

Air for operation of the meter and the two gauges is furnished by two electric motor driven self contained air compressors with five cubic feet per minute of free air capacity. The compressors are capable of compressing air up to 90 psi although for the use of the instruments it is reduced to approximately 12 psi.

Mechanical equipment is installed only when sufficient reasons exist for its use and in the case of the Venturi meter and the two gauges there is no exception to this rule.

The meter, being of the long range, extremely accurate type, is an ideal means of checking on the pump operation, providing records of the volume of sewage pumped at any time throughout the day. It is used as a means of checking the pump efficiency and enables the operator to determine whether the impeller or pump case is clogging up.

The sewage wet-well level gauge serves a distinct purpose by indicating to the operator when pumps are to be placed in operation or shut down.

The conduit level gauge also acts in the capacity of a warning device since it presents an hourly record of the liquid level and warns the operator in definite terms as to the condition of the bar screen and the necessity of cleaning it when clogging becomes too great. These three devices are sensitive and accurate plant watchdogs, the use of which is essential in efficient plant operation.

Accurate records of operations are maintained on a daily operating log. The last three vertical columns of this log are used in connection with hourly data relating to the flow meter and the two gauges.

Table I
OPERATING DATA

| | Years | |
|---|---|---|
| | 1948 | 1950 |
| Total power used, (kwh) | 989,620 | 703,120 |
| Losses (lights, etc.) | 113,340 | 96,276 |
| Power used by upmps, (kwh) | 876,280 | 606,844 |
| Sewage pumped, (gals.) | 6,962,270,000 | 6,736,090,000 |
| Average flow, (MGD) | 19.3 | 18.5 |
| Average max. flow, (MGD) | 22.0 | 26.7 |
| Average min. flow, (MGD) | 9.5 | 10.2 |
| Cu. ft. of screenings | 12,138 | 7,973 |
| Cu. ft. of grit | 5,559 | 12,433 |
| Cu. ft. of leaves | 306 | 374 |
| Sludge drawn (cu. yds.) | 63,055 | 83,441 |
| Rainfall (inches) | 48.70 | 41.76 |
| Rainy days | 130 | 136 |
| Power cost for pumping | $12,905.58 | $8,806.00 |
| Power cost (per mg.) | $1.85 | $1.31* |

* The latest available cost figure is $1.28 per mg.

## Accomplished Economies

The installation of the new Simplex recording instruments, Westinghouse electrical equipment and the De Laval pumps has paid off. The tabulations in Table I show the costs of running the old pumps in 1948 (their last full year of operation), in comparison with the operating costs for 1950, which was the first full year with the new units. The electrical charges per million gallons pumped dropped from $1.85 in 1948 to $1.31 in 1950. Assuming the 1950 daily flow as 18.5 MGD, a daily saving in electrical costs of $9.99 resulted, amounting to $3,646.35 for 365 days operation. In view of rising costs, this is the type of news taxpayers like to hear.

One advantage of the new pumps (Fig. 9) that operating personnel like is the fact that since 1949 the pumps have been opened up only three times. The non-clogging feature of the new De Laval pumps along with routine backwashing by reverse rotation has prevented clogging and practically eliminated down time.

In many pumping stations, replacing obsolete equipment with up-to-date units could also be a well worthwhile investment, resulting in lowered power costs and fewer maintenance problems.

The construction and installation was executed by Turbine Equipment Co. of New York. City supervision was under the Department of Public Works, Donal J. Connelly, Mayor and Director; Joseph E. English, City Engineer and P. N. Daniels, Sanitary Engineer in direct charge.

# SEWAGE WORKS PRACTICES

## OPERATION • MAINTENANCE • MANAGEMENT

# Characteristics of Sewage

**The Second of a Series**

*by* DON E. BLOODGOOD, *Professor of Sanitary Engineering, Purdue University, Lafayette, Ind.*

IT might seem a bit unnecessary to talk about the characteristics of a substance as common as sewage, yet only a few people outside the field of sanitation really know what sewage looks like—to say nothing about knowing what *composes* sewage.

Dr. T. B. Rice, in his lectures on bacteriology and sanitation, often colored his presentation and illustrated his point by saying that sewage was purer than Ivory Soap, inasmuch as sewage was 99.99% pure and the famous soap was advertised to be only 99.44% pure. This serves to bring out these points: (1) that sewage is composed of two substances, water and solids, and (2) that there are only a few solids in sewage as compared to the amount of water.

The purpose of sewage treatment is the removal of the solids from the liquid whether the solids be screenings, skimmings, grit, primary sludge, trickling filter sludge, activated sludge, Imhoff sludge, septic tank sludge or chemical sludge.

There are numerous ways of describing and designating the solids found in sewage. Some of the descriptions and definitions overlap. As a result, one is apt to become confused if he tries to name the various solids without any thought as to the reasonableness of his classification.

## Solids in Sewage

### Settleable Solids

Probably the simplest division of the solids in sewage is to call some of them *settleable solids*, and to call the remainder those solids that will not settle.

The test for settleable solids is made in the Imhoff cone. The unit of measurement is one of volume: milliliters of settleable solids per liter of sewage (ml/l).

Some pollution control regulations call for essentially 100 per cent removal of settleable solids. This high percentage of removal does not mean that the discharged sewage, after 100 per cent settleable solids removal, is well purified. No appreciable sludge banks will develop in a stream at the point of discharge of the sewage from which the settleable solids have been removed.

### Suspended Solids

The settleable solids are a part of the *suspended solids* in sewage, but all suspended solids are not settleable. Some of the suspended solids are so small in size and so light in weight that they would not settle out in a very long time. Such small sized particles or solids are called *colloidal solids*.

Practically all of the solids, whether settleable or colloidal, are removed when sewage is filtered through an asbestos mat or through frittered glass in the laboratory. The solids removed in such processes are those that are designated as the suspended solids.

In some industrial sewages it is difficult to differentiate between so-called suspended solids and colloidal solids. This difficulty arises because the amount of suspended material remaining on the asbestos filter, in the suspended solids tests, depends upon the effectiveness of the filter—and the effectiveness of the filter depends upon the deposit on the asbestos mat.

I have tried to point out that the suspended solids content of sewage is not absolute and that the quantity indicated is only relative, depending upon the procedure used in the determination. The *Standard Methods* procedure does give a very definite idea about the quantity of suspended matter present in a sewage.

In this series, Professor Bloodgood discusses *Sewage Works Practices* in the form of simple short course lectures. Each article is designed to interest and assist plant operators, students, and all who wish to review fundamentals in this field.—The Editors

### Dissolved Solids

There are solids in sewage that are *dissolved* in the liquid just as sugar is dissolved in coffee. None of these dissolved solids are settleable, of course.

Many people do not realize that there are appreciable amounts of dissolved solids in so-called "pure water." These dissolved solids usually are obtained from the minerals that have been dissolved from rocks in and on the surface of the earth. These particular dissolved solids are found in sewage and, in addition, we find other dissolved materials that originate from the domestic and industrial wastes.

### Total Solids

The combined suspended and dissolved solids are known as the *total solids* of a sewage. The total solids content of a sewage can be determined by driving off the water from a sample of sewage and weighing the solids that are left. The total solids content also can be determined by weighing the amount of suspended solids filtered out of a sample of sewage and adding that weight to the weight of solids remaining after evaporating the water away from the liquid that passed through the filter. This brief description of the method of determining solids is given here to aid in understanding the different types of solids.

### Removal of Solids

The settleable solids and part of the suspended solids can be removed by the sedimentation step in sewage treatment processes; thus, the determination of settleable and suspended solids can be used as a guide in the operation of the sedimentation process in a sewage treatment plant. To remove the dissolved solids from sewage it is necessary to apply chemicals that will combine with them to form suspended solids, or to utilize bacteria to remove the solids by the complicated processes that they employ in securing food.

### Volatile Material

All the types of solids mentioned previously are made up of two components: (1) organic materials and (2) inorganic materials.

Sometimes the organic solids are also called *volatile solids* because when they are burned they break up and will be partially driven off as gases.

Usually the volatile solids consist of the bodies of plants and animals or portions of them. The volatile solids are the solids that are decomposed by bacterial action, and the result of decomposition may be the creation of a nuisance under certain conditions.

The inorganic or non-volatile solids in sewage are inert and not objectionable unless they are poisons, such as the chromium salts. The most common and apparent inorganic solid in sewage is clean grit. Grit is objectionable only when it is found to contain organic or volatile solids.

### Solids Content

The data given in Table I have been taken from the annual reports of the cities listed. This information gives one an idea of the relative amounts of the various solids that are found in sewage.

SEWAGE is filtered through Gooch crucibles to determine suspended solids

Table I

SOLIDS IN RAW SEWAGE

| Sewage From | Settleable ml/l | Total ppm | Total Volatile ppm | Suspended ppm | Volatile Suspended ppm | Dissolved ppm | Volatile Dissolved ppm |
|---|---|---|---|---|---|---|---|
| Danville, Ill. (1951) | 5.6 | — | — | 149 | — | — | — |
| Findlay, Ohio (1950) | 3.6 | 750 | 301 | 169 | — | 581 | — |
| Minneapolis-St. Paul, Minn. (1950) | 6.5 | 770 | 357 | 310 | 233 | 537 | 124 |
| Jackson, Mich. (1951) | — | 939 | 324 | 187 | 114 | 752 | 210 |

The non-volatile solids are also called inorganic solids or ash.

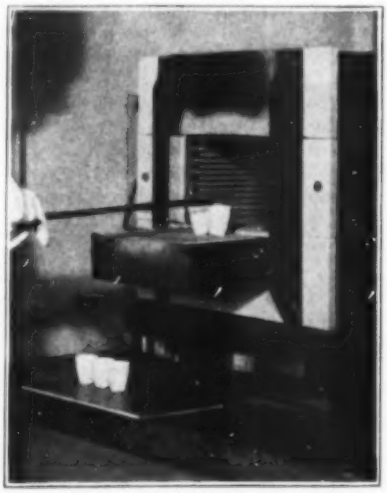
## Composition of Organic Solids

The volatile or organic solids are made up largely of the elements carbon, hydrogen, oxygen, nitrogen and sulfur. In the various combinations of these elements there are formed organic compounds commonly known as carbohydrates, proteins and fats. The carbohydrates are made up of carbon, hydrogen and oxygen, as are the fats. The proteins in addition to the carbon, hydrogen and oxygen contain some nitrogen and sulfur.

### Decomposition Processes

In the treatment of sewage, means must be provided to remove volatile (organic) solids from the liquid—then these solids must be acted upon in some way to form simpler compounds or elements. Some volatile solids are readily available as food for bacteria; others are not easily broken down.

To determine whether a sewage contains volatile solids that can easily be broken down by bacteria is not an easy task. If it were not for the different resistance of various volatile solids to bacterial action, it would be quite easy to determine the pollutional effect of a sewage simply by determining its volatile solids content.



Suspended solids are ignited to determine volatile solids and ash

The B.O.D. test (biochemical oxygen demand) has been devised to determine the availability of the volatile solids as food for bacteria. In the treatment of sewage, the plant operator may find it helpful to consider that he is maintaining an army of bacteria to consume the sewage as food. The B.O.D. test does not directly measure the amount of volatile solids that can be consumed by bacteria eating the sewage solids, but it does measure the amount of oxygen required by bacteria when they consume the volatile solids that they can use as food.

## Acidity of Sewage

The average taxpayer usually has an idea that a sewage is very acid. As a matter of fact, most sewages are just slightly alkaline in pH value; but the concentration of the alkalinity is so low that, for all practical purposes, sewage can be considered to be neutral—unless there is some unusual

quantity of an industrial waste present in a sewage.

The acidity or alkalinity of a sewage is, in most cases, measured on the pH scale. On this scale 7.0 is the neutral point; values higher than 7.0 indicate slightly alkaline conditions, and those below indicate acidity.

Table II

pH of Raw Sewage

| Sewage From | pH Value |
|---|---|
| Minneapolis-St. Paul, Minn. (1950) | 7.4 |
| Indianapolis, Indiana (1950) | 7.6 |
| Danville, Illinois (1951) | 7.2 |
| Aurora, Illinois (1950) | 7.4 |
| Worcester, Mass. (1950) | 7.0 |
| Gary, Indiana (1950) | 7.0 |

Table II gives the average pH value of the raw sewage from several cities. The examples cited would be considered to be characteristic sewages as far as pH value is concerned. The pH test measures the active acid that is present in sewage. A sewage of pH 4.5 would probably be very corrosive to metal or concrete. (A sewage having a pH value of 4.5 is ten times as acid as a sewage having a pH value of 5.5.)

## Fats, Oils and Greases

Some sewages contain appreciable amounts of fats and oils. Mineral oils are not decomposed by bacteria that carry out the decomposition of sewage solids. Organic fats and oils can be consumed as food by certain bacteria. Some of the fats, oils, and greases in sewage come from the materials used in making ordinary hand and laundry soaps. The fats and oils do not necessarily float on the surface of the sewage, but may be finely divided and dispersed throughout the liquid.

Tests for the amount of fat-like materials are not simple to make, and there is not a vast amount of data on the quantity of grease in sewage. The grease content of the Indianapolis, Ind., sewage averaged 59 ppm for the year 1937. The Worcester, Mass., annual report gives the grease content of sewage for 1950 as 100 ppm. The U. S. Public Health Bulletin No. 132 cites 53 ppm of grease in the raw sewage as the average of sixteen cities.

## Nitrogenous Materials

The nitrogenous materials found in sewage are present as complex organic compounds such as proteins, or as residual products of decomposition remaining after the bacteria use the protein materials as food. Proteins contain a great deal more carbon, hydrogen and oxygen than nitrogen. In a protein, or a so-called nitrogenous compound, the nitrogen makes up only 15 to 19 per cent of the total.

### Body Wastes in Sewage

A good many years ago two reseach workers collected information on the weight of fecal matter and urine discharged per capita per day. These data[1] show that the average weight of fecal discharge per day is 82.5 grams, and this amount contains 22.8 grams of dry solids. The moisture content on this basis would be 77.6 per cent.

The quantity of urine discharged by the individuals included in this same study was 967 grams, and this amount was found to contain 6.5 grams of dry solids. The sum of the two quantities of dry solids would be 29.3 grams per day. The fecal matter was found to be 87 per cent organic matter and the urine solids were found to be 37 per cent organic matter.

I have never found any information that tells how much of these 29.3 grams is soluble in water. Probably a considerable portion of the total weight (in addition to the 6.5 grams in the urine) is quite readily dissolved; therefore, all of the solids could not be expected to be found in sewage as suspended solids.

If all of the solids contributed by fecal matter and urine were present as suspended solids, they would make up only a small share of the suspended solids found in sewage. To illustrate the point we might take the statement from the Mnnneapolis-St. Paul Sanitary District Annual Report of 1950. This reports that the suspended solids per person in the sewage amounted to 145 grams. Compare that amount with the 29.3 grams obtained in the studies cited and it will be seen that, on this basis, the true body waste solids make up only about 20 per cent of the solids in the St. Paul-Minneapolis sewage. There may be considerable inaccuracy in these illustrating figures, but they do show that sewage includes suspended solids in addition to those from body wastes.

**Reference**

1 Rafter, G. W. and Baker, M. N., "Sewage Disposal in the United States," D. Van Nostrand Company.

## Logan Kerr Elected "Fellow" in Am. Soc. Mechanical Engrs.

**Recognition of Contributions to Hydraulic Engineering**

S. Logan Kerr has been elected by Council as a Fellow of The American Society of Mechanical Engineers. He is a consulting engineer, President of S. Logan Kerr & Co., Inc., Flourtown, Pa., and also vice-president and general manager, Lyophile-Cryochem Corp., Baltimore, Md.

Mr. Kerr is widely known for his work as a hydraulic engineer, particularly in the fields of water power, public water supply, pumping, water hammer and surge control. He aided in the solution of surge and water hammer problems in motor-driven water works pumping systems, including those of the cities of New York and Toledo, Ohio, the St. Louis County Water Co. and others.

Active in ASME affairs, Mr. Kerr is presently chairman, Committee on Power Test Codes for Hydraulic Prime Movers, a member of the Hydraulic Division Executive Committee of which he was Chairman in 1936-1938, organizer and chairman since 1931 of Committee on Water Hammer.

Mr. Kerr has also for a number of years been chairman of A.W.W.A.'s Committee on Water Hammer and has presented a number of papers on Surge and Water Hammer Correction before the Association.

## Sewage Works Construction Progress in New England

The success of programs for water pollution control in New England is reflected by the construction of sewage treatment works. Accomplishments of the States in this field during 1952 are noteworthy, particularly in view of such adverse factors as the steel strike and priority restrictions on materials and regulations on construction under the National Defense Program.

The inventory of sewage works construction shows that in the New England Interstate Water Pollution Control Compact area during 1952, sewage works costing $22,000,000 were completed. These included seven new sewage treatment plants having a capacity of 170 million gallons daily and serving over 1,000,000 persons. Under construction at the end of 1952 were sewage works estimated to cost $42,000,000 including nine new sewage treatment plants.

Since 1949 sewage works valued at over $76,000,000 have been completed or construction started. These works include 32 new sewage treatment plants for treating over 270 million gallons per day from a population of approximately 1,650,000.

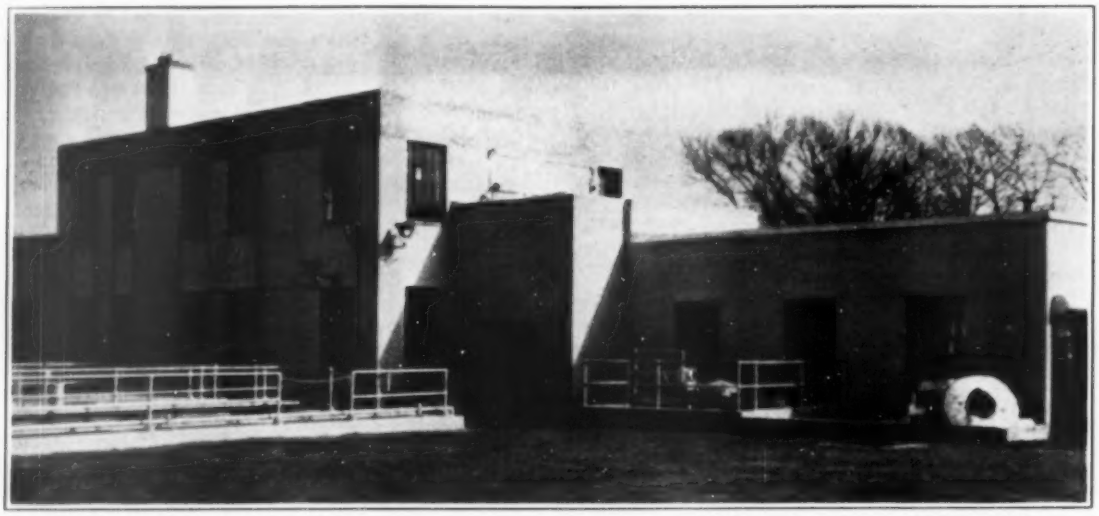


Fig. 1—WEST HAVEN, CONN. Rear view shows aeration tank, elutriation unit, and new chlorine building

# Modernization of West Haven Sewage Treatment Plant

## Adding Secondary Treatment in Major Reconstruction Project Converts Old Plant into New

*by* EDWIN B. COBB, *Partner, Metcalf & Eddy, Engineers, Boston, Mass.*

THE town of West Haven, Connecticut is situated along the westerly boundary of the city of New Haven. It is a leading suburb of that city and includes an important recreational area and a number of diversified industries. The 1950 Federal census gave the population of the Town at 32,010.

West Haven has a land area of about 7,000 acres, of which about half are built up and the remainder range from residential developments to farm land. The waterfront, southwesterly from New Haven Harbor, is used extensively for bathing and at Savin Rock there is a shore amusement center. Along the shore front are numerous summer residences. In 1948 about 55 industrial and commercial enterprises were listed as located in West Haven; among these were a rubber manufacturing plant and several metal-working plants.

The sewage originating in the Town appears to be principally of domestic origin. Aside from the occasional discharge into the sewers of oil, gasoline, or volatile solvents, industrial wastes do not seem to present any particular problem in the treatment of this sewage.

### Early Sewerage System

The major portion of the sewerage system was constructed about 1914 following designs made by the late Clyde Potts. The system is of the separate sanitary type, and connections to roof or surface water drains are prohibited by ordinance. However, as is common in many towns, there are undoubtedly a number of illegal connections.

The sewerage system is divided into two parts; the low-level system, which serves the low-lying area along the water-front, and the high-level system which serves the remainder of the Town. The high-level system is the larger of the two. Both systems discharge to a single sewage treatment plant located on Blohm Street, several blocks inland from the Savin Rock beach area. The low-level sewers terminate at the plant in a 24-in. sewer with its invert at El. 4.0 (El. 0.0 is mean low tide). The high-level sewers terminate in a 24-in. sewer with its invert at El. 7.0.

### First Treatment Plant

The first sewage treatment plant consisted of a battery of four Imhoff tanks serving the high-level system, and two Imhoff tanks serving the low-level system. At low tide level the effluent from the Imhoff tanks was carried by pipeline to an outfall in New Haven Harbor easterly of the Savin Rock beach area. Sludge from the Imhoff tanks was pumped to adjacent sand beds for dewatering. At high tide the outlets of the low-level Imhoff tanks were submerged. To remedy this condition, a receiving basin was provided to store the effluent during high tide and to discharge it during the following low tide.

The plant was situated in a tidal marsh, and the foundation conditions presented difficult construction problems. The Imhoff tanks and other structures have wood pile foundations.

### Corrective Measures

Odors from the Imhoff tanks, caused by septic sewage, led to the redesign and reconstruction of the plant in 1936 and 1937 by the late

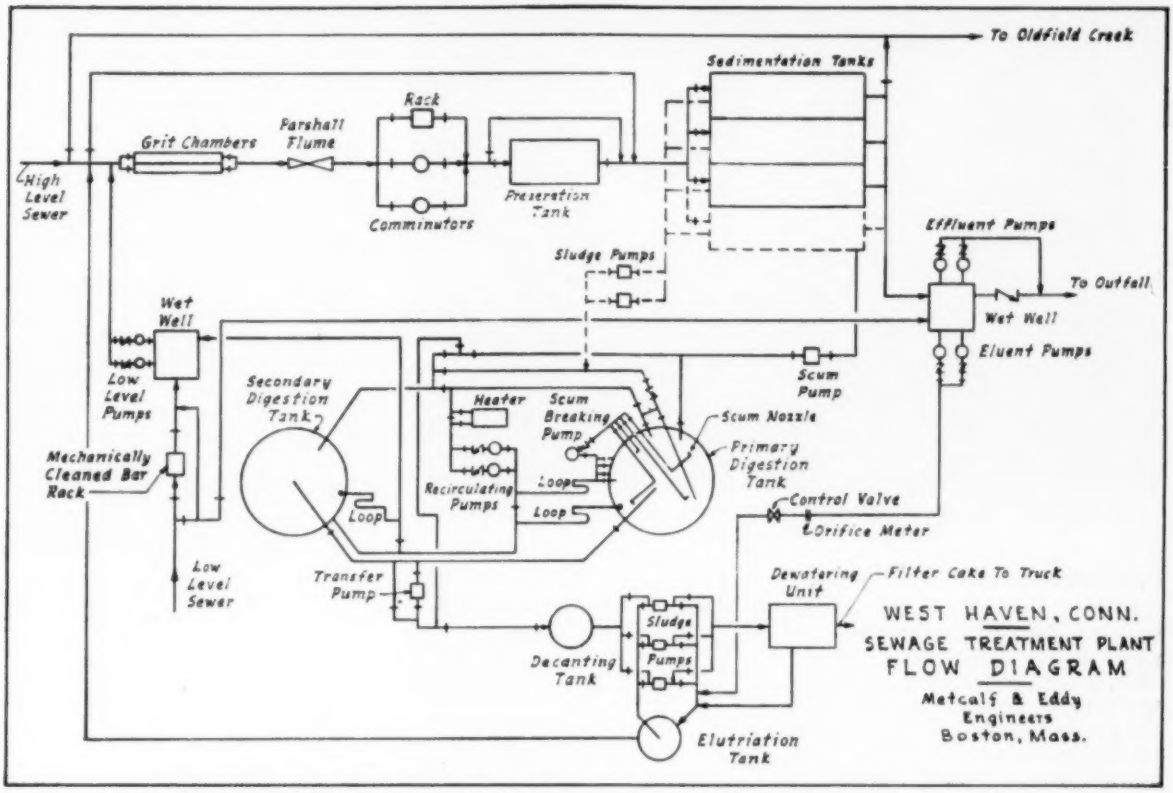



Fig. 2—FLOW DIAGRAM illustrates layout of the reconstructed West Haven sewage treatment plant

Alexander Potter. Three of the high-level Imhoff tanks were converted to mechanically cleaned sedimentation tanks, and the fourth was roofed over to provide emergency sludge storage. A manually cleaned coarse rack (4 in.) followed by a mechanically cleaned fine rack (1 in.), together with sludge pumping facilities were provided in a new structure at the influent end of the sedimentation tanks. A low-level wet well with manually cleaned bar rack and sewage pumps was constructed in one of the low-level Imhoff tanks. The pumps lifted the low-level sewage into the high-level system at a point just ahead of the new coarse rack.

The sewage reaching the plant during the warm weather months was often septic, and the solids were finely divided. To correct this condition and to permit added treatment during the bathing season, the engineers included in the reconstruction facilities for chemical treatment of the sewage. A by-pass arrangement was provided between the new mechanically cleaned rack and the sedimentation tanks which conveyed the sewage to a flash-mixing tank constructed in a portion of one of the lowlevel Imhoff tanks. Lime and iron salts were added at this tank, and the mixture subjected to rapid stirring. From this tank the sewage flowed to a flocculating tank constructed across one end of the receiving basin. In the flocculating tank, the sewage was subjected to slow agitation by steel paddles rotating about a horizontal shaft. The flocculated sewage then flowed through an open channel back to the sedimentation tanks. In considering this phase of the design, it should be remembered that it was about this time that the chemical treatment of sewage was staging a sort of comeback.

The effluent from the sedimentation tanks was led to the former sludge pumping station where a weir was provided for flow measurement. The basement of the station was converted into a wet well and two vertical, propeller-type pumps were provided to pump the effluent during periods of high tide. A backwater gate was also provided in the wet well which permitted gravity flow of the effluent to the outfall during periods of low tide.

The design called for sludge digestion tanks, but owing to lack of funds they were omitted and the dewatering of raw sludge on vocuum filters was substituted. A two-story combination filter, chemical storage, and administration building was constructed over a portion of the low-level Imhoff tanks. This location was chosen to avoid the necessity of constructing additional pile foundations.

Sludge from the sedimentation tanks was dewatered on a batch basis. It was first pumped to a 2,000-gal. capacity decanting tank in the filter building from which, after removal of any separating water which could be decanted, the sludge was discharged by gravity to a conditioning tank at the vacuum filters. Lime and ferric chloride were added to the sludge in this tank, and the mixture agitated by compressed air. Two vacuum filters of 56 sq. ft. capacity each were provided for dewatering. The filter cake was discharged to a pan-type conveyor which carried it up a steep slope to a hopper from whence it was discharged to a truck.

Two chlorinators were also provided at the filter building. One was used for prechlorination, and fed chlorine solution to the high-level rack channel. The other unit fed chlorine to the wet well at the outfall pumping station. Most of the chlorine was applied by prechlorination.

The plant was designed to handle an average daily flow of 3.25 mgd and a maximum flow of 5 mgd. This capacity was considered adequate for a connected population of 37,800 expected in 1965.

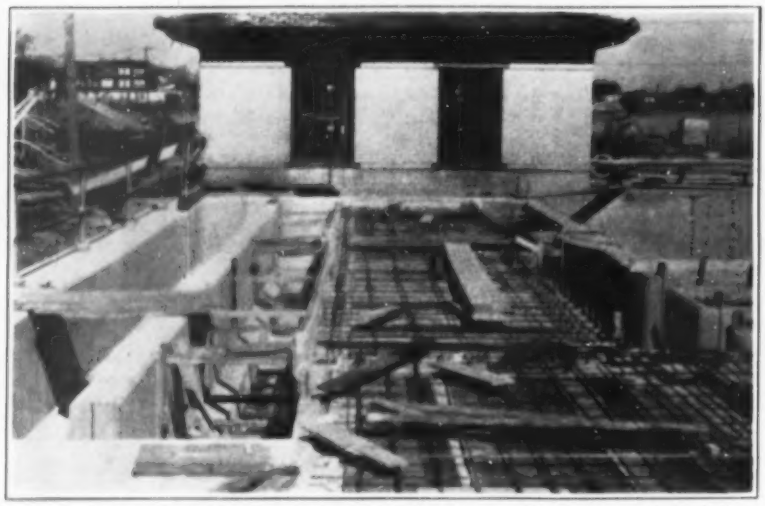


Fig. 3—VIEW TOWARD effluent pumping station shows grit chambers and Parshall flume under construction

## Operating Problems

Periodic analyses of the sewage made by the Connecticut State Department of Health from 1938 to 1947, showed that the sewage flowing to the plant contained an average of 287 ppm of suspended solids, and had an average B.O.D. of 355 ppm. Maximum values reported by the analyses were 460 and 620 ppm respectively. By comparison, a domestic sewage averaging 100 gcd commonly contains about 200 ppm each of suspended solids and B.O.D. It has been reported that the West Haven sewage is about the strongest in Connecticut.

Due to repeated failures of the old telemetering system serving the measuring weir, a continuous record of sewage flow since the plant reconstruction is not available. From the portions of record which are available, the highest monthly daily average flow occurred in June, 1946, amounting to 2.86 mgd. The lowest monthly daily average flow occurred in September, 1944 and was 0.75 mgd. During the summer and late fall of most years, the average daily flow approached 1 mgd.

The above flows appear unusually low for about 60 miles of sewers, and a connected population of about 25,000 persons. The average daily water consumption for West Haven in 1947 was 3.1 mgd, and of this amount 250,000 gpd are known to have been discharged to a creek.

Experience showed that flows in excess of 3.7 mgd would overtop the rack channel and flood the sludge pumps. During wet periods, the flow frequently exceeded this amount and bypassing was necessary.

The principal cause of the lack of capacity was some improvised bar racks the operator had installed in an effort to intercept rags and stringy material in the sewage. The effluent pumps being of the propeller type were equipped with suction screens and occasional rags which slipped through the bar rack frequently plugged these screens. The operator had installed one bar rack with 1-in. openings in the channel following the mechanically cleaned high-level rack and a second rack in the effluent channel upstream from the measuring weir. These racks together added nearly 1 ft. additional loss of head to the hydraulic profile through the plant.

The analyses made by the State Health Department indicated average removals of suspended solids of 67.3 per cent and of B.O.D. of 43.7 per cent. These are excellent removals for a primary treatment plant.

Chlorination was employed during the bathing season only. The effluent sewer affords contact periods ranging from over 2 hr. for the average dry-weather flows down to about 30 min. for a maximum flow of 5 mgd. Chlorine demands as high as 35 ppm were experienced. Bacteriological studies by the Department of Health showed that when 0.5 ppm of residual chlorine was present at the effluent pumping station the effluent at the outfall would meet the requirements of the Interstate Sanitation Commission. These standards require that not more than 50 per cent of samples collected shall have coliform numbers in excess of 100 per milliliter.

## Raw Sludge Filtration is Unsatisfactory

The dewatering and disposal of raw sludge proved to be an arduous and expensive task and most unsatisfactory. Sludge storage facilities in the covered former high-level Imhoff tank were adequate for only about 14 days production, and this capacity then fixed the length of time the dewatering equipment could be taken out of service for repairs or maintenance. The capacity of the dewatering equipment proved to be only a little more than the daily production of sludge. Obviously, the disposal of any stored sludge in addition to the daily production presented a difficulty.

The budget allowance for lime and ferric chloride in 1948-1949 for conditioning the sludge was about $7,400 or nearly $16 per ton of dry solids in the sludge. In addition, filter operation was a 7-day week task, frequently requiring up to 12 hr. per day. The raw sludge was difficult to filter since it smeared the cloth, and the large volume of lime used caused rapid blinding of the cloth. The combination of the conditioning chemicals and the sloppy, sticky, smelly, decomposing raw sludge made for very unpleasant working conditions. Because of odors and bacterial hazards, the filter cake was not considered suitable for soil conditioning, and it was therefore disposed of on a public dump across the street from the plant. At the dump it was necessary to keep the sludge separated from the active dumping areas since it could be ignited, and upon combustion made a smoky, odorous fire.

Because of the general excellence of the removals by the sedimentation tanks without the help of chemical treatment, the cost of chemicals, and the difficulties in coping with any additional sludge load, the chemical treatment portion of the plant was never operated except for an initial two-week tuning up period.

## Plant Reconstruction

In 1948, the writer's firm was called in to design sludge digestion facilities, and to make recommendations regarding desirable improvements and additions to the plant. After a study of the problem, the following additions and alterations were recommended; and they have subsequently been constructed and placed in operation:

1. The provision of grit chambers.
2. The installation of comminutors on the high-level system and the transfer of the mechanically cleaned rack to the low-level system.
3. The reconstruction of the chlorine-handling facilities.
4. The provision of new flow-measuring facilities.
5. The provision of preaeration facilities.

6. The installation of cross collectors for sludge removal in the sedimentation tanks.

7. The alteration of the influent baffles in the sedimentation tanks.

8. The provision of mechanical scum-skimming equipment in the sedimentation tanks.

9. The provision of sludge digestion facilities.

10. The provision of new sludge dewatering facilities including sludge elutriation.

11. The provision of a new electrical control center.

The reconstructed plant has been designed to treat an average daily flow of 2.35 mgd from a connected population of 40,000 persons. These loadings are expected to be reached in about the year 1970. Provision was made for a maximum flow of 6.5 mgd. In the following paragraphs, the writer will describe briefly each of the preceding recommendations.

### Grit Chambers

Although the sewerage system is largely separate, grit does find its way into it. Grit chambers have been provided to reduce the wear on the comminutors, sludge collectors, and sludge pumps, and to prevent accumulations of grit in the digestion tanks.

The grit chambers consist of parallel channels 46 ft. long proportioned to provide a velocity of flow within the range of 0.6 to 1.2 ft. per sec. Water-level control is by means of a Parshall flume located beyond the downstream end of the chambers. Flow to the individual channels is controlled by aluminum slide gates.

The grit chambers were located in a portion of the old receiving basin to take advantage of its pile foundation and to help eliminate this unsightly structure. The remainder of the basin was converted into a grit drainage bed with a ramp entrance provided so that a truck could enter it to be loaded with the drained grit. The grit is washed through a pipe from the channels to the bed, either by manipulating the inlet slide gate and allowing surges of sewage to flow along the channel and out the drain, or by flushing with a hose stream. Drainage from the bed flows to the low-level wet well.

The wisdom in providing grit chambers is demonstrated by the fact that it is necessary to remove accumulations of grit from them almost weekly. More than 100 cu. ft. of grit was removed monthly from December, 1951 through March, 1952.

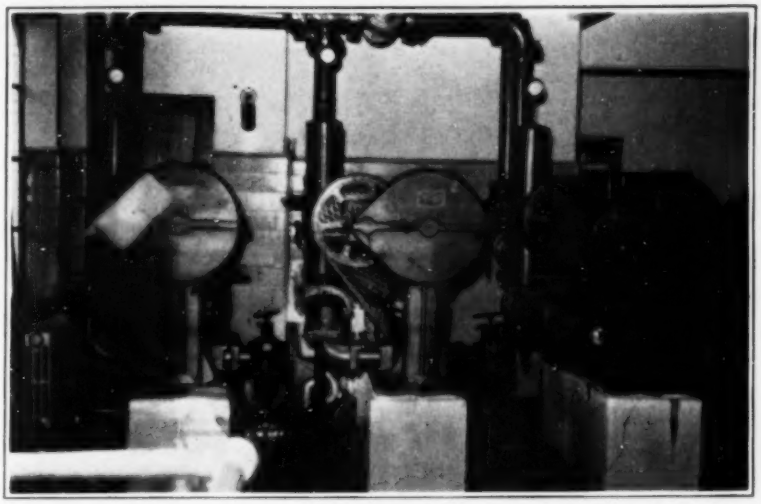


Fig. 4—SLUDGE PUMPS in main operating building serve elutriation tank and vacuum filter

### Comminutors

The numerous bar racks in the system, each causing a loss of head of several inches, seriously affected the maximum flow capacity of the plant. The manual cleaning of four bar racks together with the handling of the screenings from the mechanically cleaned rack was laborious and required continuous attendance. Disposal of screenings by dumping on adjacent land and covering with sand was unsatisfactory because of odors and unsightliness, and entailed an appreciable yearly expense for sand and lime used to control odors. The removal of the mechanically cleaned rack permitted reconstruction of the rack channel to permit an increase in the hydraulic capacity of the plant.

Two Chicago Pump Company 25A comminutors were installed downstream from the grit chambers. A manually cleaned bypass rack was also provided. These units appear to have been successful in greatly reducing the clogging of the screens of the effluent pumps by rags and at the same time, have eliminated the screenings disposal problem.

Rather than install a second pair of comminutors to eliminate the manually cleaned rack protecting the low-level pumps, it was decided to reinstall the mechanically cleaned rack in its place. The relocated rack was installed at the westerly end of the old low-level Imhoff tanks, and the main operating building was extended to house it by constructing a new wing. Screenings from the rack are disposed of by dumping into the channels ahead of the comminutors. Both high- and low-level sewages pass through the grit chambers and the comminutors.

### Chlorine Handling Facilities

The relocation of the mechanically cleaned rack necessitated changes in the facilities for handling, storing, and feeding chlorine which is received in ton containers. The existing facilities were inconvenient; the chlorine scales were in a cramped location adjacent to the filter cake hopper and exposed to spillage of the cake during operation.

A new chlorine scale room was constructed as a part of the new wing housing the mechanically cleaned rack. This room was equipped with a 7,000-lb. platform scale adequate to hold two one-ton containers. Portions of the existing monorail and the carrier were salvaged and included in a new monorail system serving a paved storage area in front of the main building. Two short sections of railroad track were provided on which to set the containers, each section being adequate for about 15 containers. The monorail serves the entire length of one track which is used for full containers. A short spur serves one end of the other track which is used for empties, the containers being rolled by hand to and from the monorail spur. Since the monorail spans the driveway, trucks are unloaded and loaded at this point.

### Flow-Measuring Facilities

It was recommended that a Parshall flume be provided between the grit chambers and the comminutors for the following reasons:

(a) The grit chambers required a control device to hold the velocity of flow through them within the range best suited to the settling of grit.

(b) The existing weir at the effluent pumping station backed up the

flow over the weirs of the sedimentation tanks at times of high flow.

(c) Measuring the flow following passage through the sedimentation tanks hid the magnitude of peak flows of short duration because of the storage effect of the tanks. Furthermore, the bypass outlets were all located ahead of this weir, and therefore, certain bypassed flows could not be metered.

(d) The existing flow recording instruments were unservicable and needed replacement.

The Parshall flume was equipped with a Builders-Providence float-operated indicating, recording, totalizing instrument with telemeter transmitter mounted in a cast-iron, weatherproof stand installed beside the flume. A telemeter-actuated indicating, recording instrument was located in the new electric control room.

The reason for the elaborate outdoor installation was to insure a continuous flow record in spite of possible failure of the telemeter system which had been the fault of the previous installation. Only indicating the totalizing were required for the outside instrument, but the manufacturer furnished the recorder at no additional cost. Normally no chart is placed on the outside instrument.

### Preaeration Facilities

The sewage reaching the plant during the summer months is often in a septic condition, and the presence of considerable hydrogen sulfide has been apparent. The hydrogen sulfide was believed to be a cause of the excessive chlorine demands as previously noted. To correct this condition, it was decided to convert the existing cumulations of grit in the digestion tank.

The conversion was effected by suspending pairs of Chicago Pump Co. "Precision" type diffuser tubes in a single row from drop pipes connected to an air supply header along one side of the tank. A valve and a union permit ready removal of the drop-pipe assembly without necessitating the shutting down of the system or the unwatering of the tank.

A Roots-Connersville positive displacement type blower of 125-cfm capacity installed in the main building provides the air supply. The preaeration tank provides a detention time of about 20 min. for the design average flow of 2.35 mgd.

No laboratory analysis of the effect of the preaeration has been made, but there is a decided absence of disagreeable odors about the plant and the operators are of the opinion that the appearance of plant effluent has been improved.

Troubles with the disposal of digester supernatant have masked the effect of preaeration on reduction in chlorine demands. More conclusive information is hoped for during the coming chlorinating season since changes in the method of supernatant disposal have been made.

A diffuser for prechlorination of the sewage was installed at the outlet of the preaeration tank.

### Cross Collectors at Sedimentation Tanks

The high-level Imhoff tanks are reconstructed to form the sedimentation tanks provided only single hoppers for sludge removal at the influent end of each tank. A single sludge withdrawal pipe was provided at the center of each hopper.

The side slopes of these hoppers were found to be too flat to permit sludge to slide to the withdrawal pipe. As a result, it was necessary during sludge pumping operations to have a man with a pole push the sludge to the withdrawal pipe.

To eliminate the necessity of the handwork in moving the sludge, a Walker Process "Helicoid" cross-collector was installed. This unit consists of a screw conveyor having opposed pitches on either end which thereby moves the sludge to the draw-off pipe. This equipment has proved most successful.

### Alteration to Influent Baffles

Wooden baffles were provided at the influent end of each of the sedimentation tanks. The tops of these baffles extended several inches above the water surface and thereby tended to trap floating solids such as match sticks, garbage, etc. This floating material was unsightly, and it was necessary to remove it at frequent intervals by hand skimming.

The tops of the baffles were lowered to about 2 in. below the water surface which allowed the floating material to escape and thus eliminated the problem.

### Mechanical Scum Skimmers

With the strong sewage prevailing at West Haven, large quantities of scum collected in front of the baffles at the effluent ends of the sedimentation tanks. Removal of the scum was a laborious task of hand skimming.

A Walker-Process "Helaskim" was provided in each tank to mechanically remove the scum. This equipment consists of a rubber-edged spiral blade rotated by a motor drive which dips below the water surface and then carries the scum up a metal beach to a trough. The scum in the trough is periodically flushed to a hopper from which it is pumped to the primary digestion tank. The equipment has practically eliminated all necessity for hand skimming.

### Sludge Digestion System

The most important phase of the project was the sludge digestion tanks. Two tanks arranged for stage digestion were provided. The primary tank has a fixed dome roof and the secondary tank has a Pacific Flush Tank Co. floating cover. Each tank is 45 ft. inside diameter, 22 ft. side water depth; conical bottomed; has insulated, brick veneered walls and is of 40,000 cu.ft. capacity. The control house is located between the tanks.

The primary tank is provided with four supernatant drawoffs, separate overflow, sludge withdrawal and sludge inlet piping. Four nozzles just above the water surface are provided for scum breaking, and are supplied by a two-speed centrifugal pump drawing supernatant from the tank. The tank contents are heated by recirculating supernatant through a Pacific Flush Tank Co. gas-fired boiler-heat exchanger unit.

The second tank is provided with a separate overflow, single supernatant drawoff, sludge inlet pipe, and sludge withdrawal pipe. The overflow and supernatant from the primary tank discharge to secondary tank and the overflow and supernatant from the secondary tank discharge to the low-level wet well.

A simplex plunger pump is provided for sludge transfer between the tanks and for pumping the secondary sludge to the sludge dewatering facilities.

Gas is collected from both tanks is used for fuel in the heat exchanger unit and for plant heating. A waste gas burner on the roof of the control house disposes of excess gas. A connection with automatic controls provides city gas for fuel when the rate of digester gas production is insufficient.

The tanks were placed in operation without the use of seeding sludge, but with the addition of lime. Considerable difficulty was had with foam-like scum which has since subsided. Part of this trouble appears to have been caused by too frequent operation of the scum-breaking jets which resulted in excessive agitation of the primary tank contents. At present, the nozzles are operated one at a time, in rotation, about an hour per day each. Recent reports indicate the presence of only a blanket of soft scum not over a few inches thick in the primary tank.

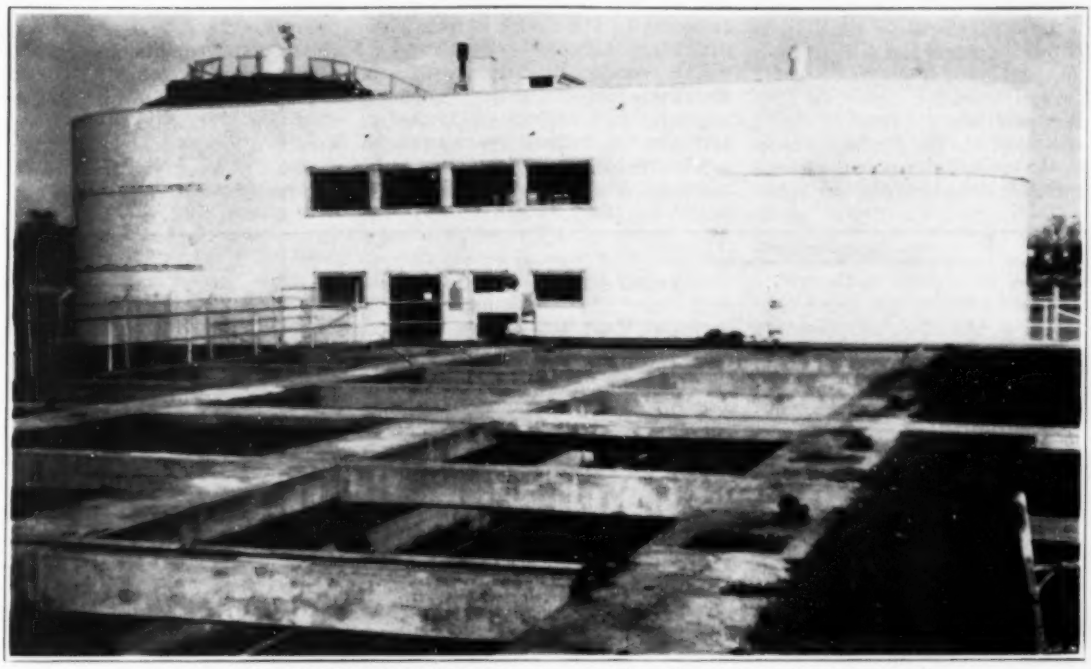


Fig. 5—NEW SLUDGE DIGESTION tank structure with old sedimentation tanks in foreground

The overflow, supernatant withdrawal, and sludge inlet pipe connections to the secondary tank are all at the same elevation near mid-depth at the tank. It now appears that the supernatant drawoff is at too high a level to enable withdrawal of the clearest supernatant. Discharge of turbid supernatant to the sewage increased its chlorine demand. The situation is believed to have been corrected by tapping the 1.5-in. sampling lines provided at lower elevations and allowing one or more of these connections to discharge continuously. This arrangement permits the selection of the clearest supernatant and spreads the discharge over a 24-hr. period.

### Sludge Dewatering Facilities

Complete new sludge dewatering facilities provided consist of elutriation and vacuum filtration. Sludge for dewatering is drawn in 2,000-gal. batches from the secondary digestion tank by hydrostatic pressure or is pumped by the transfer pump at the digestion tank control house to the existing 2,000-gal. decanting tank at the main operating building. From the decanting tank the sludge flows by gravity to one of three simplex plunger-type sludge pumps equipped with variable speed drives and located in the old filter room on the first floor of the main operating building. By manipulation of valves each of these pumps may be used to pump to the elutriation tank or to the sludge dewatering unit. An overhead loop elevated above the decanting tank is provided to prevent uncontrolled flow through the sludge pumps when discharging to the elutriation tank.

The elutriation tank was provided by reconstructing the flash-mixing tank of the old chemical treatment system. The tank is 10 ft. 6 in. diameter with 10 ft. sidewater depth, has about 7,300-gal. capacity, and is equipped with a Door Company rotary sludge collector having picket-type mixing vanes.

The eluent or diluting water is plant effluent provided by either of two 100-gpm. vertical centrifugal pumps at the effluent pumping station. The sludge and eluent are mixed in the pipeline leading to the elutriation tank. The flow of eluent is measured by an orifice meter and controlled by a lever-operated R-S butterly valve. The flow of sludge is measured and controlled by the rate of discharge of one of the simplex plunger-type sludge pumps. The over-flow from the elutriation tank is returned to the high-level sewage.

The sludge dewatering unit is an Eimco package-type unit having a vacuum filter of 100 sq. ft. filtering area. It is located on the second floor of the main operating building in the old chemical storage room. The unit consists of a sludge conditioning tank of about 75-gal. capacity equipped with a horizontal, paddle-type agitator driven by a variable-speed drive; a Nash wet vacuum pump; vacuum receiver; Jennings centrifugal filtrate pump; Victor-Acme blower; all mounted with the vacuum filter on a structural steel base. The filter drum and the vat agitator are driven by separate motors, each equipped with a variable-speed drive. The filter is provided with a clothwashing spray located under the cake stripping apron and is equipped with a drainage trough to permit washing the filter cloth while filtering. The spray pipe is extended around the ends of the drum and is valved to permit washing the drumheads at the end of the filter run.

Sludge to be filtered is pumped from the elutriation tank to the sludge conditioning tank by one of the three sludge pumps. Ferric chloride is used for conditioning the sludge. The ferric chloride is mixed in two existing rubber-lined ferric chloride mixing tanks, and is pumped by a Proportioneers feeder to the conditioning tank. The sludge is filtered on a continuous basis, a float switch being provided at the conditioning tank to shut off the sludge pump and ferric chloride feeder when the conditioning tank becomes filled to a predetermined level. The filter cake is discharged to a horizontal belt conveyor which, in turn, discharges it to the existing sludge hopper.

Disposal of the filter cake is no longer a problem and there appears to be an ever growing demand for it. It is used by the Park Department as a soil conditioner.

The elutriation tank was designed

for continuous flow operation with a 5:1 ratio of eluent to sludge. At present, it is operated on a batch basis of 2,000 gal. each batch. The sludge as pumped from the decanting tank is mixed with about 3 parts of eluent and discharged to the elutriation tank. When the entire batch is in the elutriation tank it is recirculated for a second washing, three volumes of eluent being used. The sludge is then withdrawn and filtered.

The reasons for the change in elutriating procedure is to obtain a more thorough washing of the sludge, and also to reduce the suspended solids carried from the tank in the overflow. The sludge discharge to the dewatering unit filters very well, and requires only 3 to 4 per cent ferric chloride for conditioning. The first filter blanket gave 620 hr. of service before removal. However, the turbid condition of the elutriation tank overflow is of some concern and various expedients are being tried to reduce this turbidity.

## BASIC EQUIPMENT DATA

### Sewage Treatment Plant and Sludge Handling Facilities

### WEST HAVEN, CONN.

| | |
|---|---|
| **Population Served** | |
| 1948 | 25,000 |
| Design (1970) | 40,000 |
| **Sewage Flows** | |
| 1947 Dry weather monthly av., mgd. | 0.94 |
| Estimated yearly daily av., mgd. | 1.46 |
| Design (1970), yearly daily av., mgd. | 2.35 |
| " " maximum, mgd. | 6.5 |
| **Low-Level Rack** | |
| Type (Link Belt Co.) | Mechanically cleaned |
| Width of channel, ft. | 4.0 |
| Clear spacing of bars, in. | 1 |
| **Low-Level Pumps** | |
| Capacity, gpm., No. 1 | 0 to 600 |
| " " No. 2 | 550 |
| **Grit Chambers** | |
| No. of channels | 2 |
| Length, ft. | 46 |
| Velocity range, fps. | 0.6 to 1.2 |
| **Parshall Flume** | |
| Width of throat, in. | 12 |
| Instrument | Indicating, recording, totalizing |
| **Comminutors** | |
| No. of units | 2 |
| Size (Chicago Pump Co.) | 25A |
| **Comminutor Bypass Rack** | |
| Type | Manually cleaned |
| Width of channel, ft. | 2.5 |
| Clear spacing between bars, in. | 2 |
| **Preaeration Facilities** | |
| No. of units | 1 |
| Length, ft. | 40 |
| Width, ft. | 15 |
| Water depth, ft. | 7.25 |
| Water capacity, gal. | 32,500 |
| Detention at design, av. flow, min. | 20 |
| No. of diffuser tubes (Chicago Pump Co. "Precision") | 16 |
| Air compressor | |
| No. of units | 1 |
| Capacity, cfm. | 125 |
| **Sedimentation Tanks** | |
| No. of units | 3 |
| Length, ft. | 103 |
| Width, ft. | 11.7 and 11.5 |
| Av. water depth, ft. | 8.4 |
| Combined water capacity, gal. | 223,500 |
| Detention at design av. flow, hr. | 2.4 |
| Overflow rate at design av. flow, gal./sq.ft./day | 660 |
| Mechanical sludge and scum-collecting equipment | |
| **Raw Sludge Pumps** | |
| Type | Simplex plunger |
| No. of units | 2 |
| Observed capacity, gpm. | 35 |
| **Scum Pump** | |
| Type | Simplex plunger |
| No. of units | 1 |
| Rated capacity, gpm. | 75 |
| **Sludge Digestion Facilities** | |
| No. of digestion tanks | 2 |
| Diameter, ft. | 45 |
| Sidewall water depth, ft. | 22 |
| Cone depth, ft. | 7.5 |
| Unit capacity, cu.ft. | 40,000 |
| Type of cover, primary | Fixed |
| " " " secondary | Floating |
| Heating facilities | |
| Recirculated supernatant heated by gas-fiired boler heat-exchanger unit. | |
| Primary tank heated only | |
| No. of recirculating pumps | 2 |
| Unit capacity, gpm. | 150 |
| Scum control facilities | |
| Recirculated supernatant discharged through four fixed nozzles above the scum blanket | |
| No. of recirculating pumps | 1 |
| Unit capacity, high speed, gpm. | 700 |
| " " low speed, gpm. | 150 |
| Sludge transfer pump | |
| No. of units | 1 |
| Type | Simplex plunger |
| Unit capacity, gpm. | 75 |
| Gas collection facilities for both tanks, gas metering equipment, and waste gas burner | |
| **Elutriation Facilities** | |
| No. elutriation tanks | 1 |
| Diameter, ft. | 10.5 |
| Sidewall water depth, ft. | 10.75 |
| Capacity, gal. | 7,300 |
| Eluent | |
| Source | Plant effluent |
| No. of pumping units | 2 |
| Unit capacity, gpm. | 100 |
| **Sludge Dewatering Unit** | |
| Type | Eimco package unit |
| Equipment—Vacuum filter, conditioning tank, wet-type vacuum pump, low-pressure blower, vacuum receiver, filtrate pump | |
| Rated filtering area, sq.ft. | 100 |
| Design filter yield, lb./sq.ft./hr. | 5 |
| Conditioning chemical | Ferric chloride |
| **Outfall Pumps** | |
| Capacity, gpm., No. 1 | 880 |
| " " No. 2 | 2,500 |
| **Chlorinators** | |
| No. of units | 2 |
| Unit capacity, lb./day | 300 |
| Available dosage at design, av. flow, ppm. | 30 |
| Provision for pre- and postchlorination | |
| Contact time in effluent conduit, min. | 60 |

### Electrical Control Room

The existing electrical control panel was located in the old filter room together with the chlorinators. The combination of fumes and dampness from the filtering of raw sludge, coupled with chlorine fumes escaping from the chlorinators was more than any electric control panel could take. Space was also required for the sludge pumping units of the dewatering system, and new equipment being installed, required additional control panel facilities.

It was decided to provide an entirely new control panel and to locate it in what was formerly the locker room. New locker facilities were to be provided in a portion of the laboratory which was overlarge, especially as there was no chemist on the staff. Removal of the existing vacuum filters (found to be worn out) permitted the locketr room to be located in the old filter room, and the laboratory was left unchanged.

### Construction Problems

The construction of new facilities on the location of two previous plants presented numerous difficulties in avoiding, or connecting to, buried or underwater structures of uncertain location. A very complete set of record drawings of the previous plant construction was available and helped immeasurably. Furthermore, Mr. Burrell, the plant superintendent, had been resident engineer on the previous plant reconstruction, which made him of great assistance. Work was complicated by the necessity of continuing to treat sewage and to dispose of raw sludge. Little or no bypassing of the sewage was permitted during the bathing season.

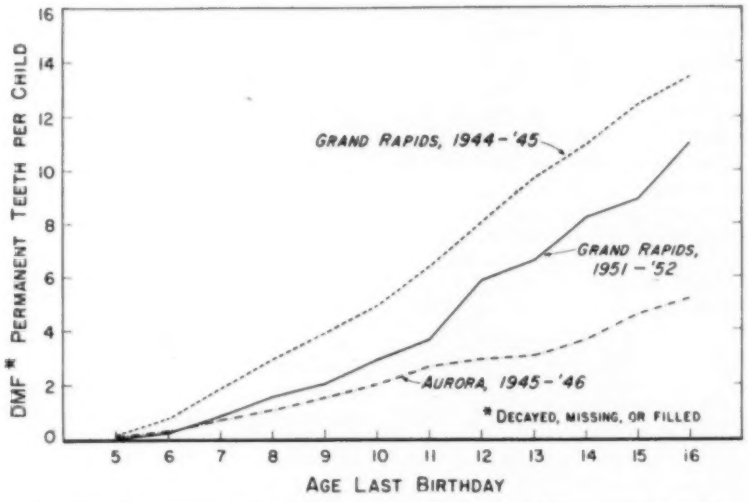
Progress of the work revealed unsuitable foundation conditions under the digestion tanks to even a greater depth than had been anticipated. This condition required the redesign of the pile foundations for these tanks. Cast-in-place concrete piles of the "Cobi" type suitable for 40-ton working load were used in the redesign. The longest pile driven was about 82 ft. in length.

The cost of the alterations and additions was $384,314 of which about $51,800 was for pile foundations.

### Acknowledgement

Metcalf & Eddy, Engineers, Boston, made the engineering studies, prepared the plans and specifications for construction, and provided general supervision of the project. C. W. Blakeslee & Sons, Inc. Contractors of New Haven, Connecticut were the general contractors. Mr. Grey W. Curtiss of West Haven was resident engineer during construction, and was aided by Mr. Robert Burrell, the plant superintendent. Mr. Frank Flood was partner-in-charge for Metcalf & Eddy, and the writer was Project Engineer.

## Latest Fluoridation Results at Grand Rapids, Mich.




AFTER eight years of fluoridation at Grand Rapids DMF permanent teeth per child 5 to 15 yrs. old.

In *Water & Sewage Works* for January 1953 was published the latest results of fluoridation at Sheboygan, Wis. Herewith the like results from Grand Rapids, Mich., where water fluoridation was first introduced some eight years ago. The accompanying graph was made from the tabulated record below. It can be observed that the condition of the teeth of children having had fluoridated water from birth is approaching that of the teeth of children up to age of nine years in Aurora, Ill., where the well water contains natural fluorides in optimum amounts to reduce dental decay.

From the tabulated results it becomes apparent that the maximum reduction in DMF was observed in the six year old group—namely, 66.6% reduction. Why the reduction observed in the five year old group was but 56% is not explained. As to be expected, the reduction becomes less in the groups of older children who have had fluoridated water for only a portion of their lives. Examination of the 1952 results at Sheboygan, Wis. (*W. & S.W.* Jan. '53 p. 41) reveals a maximum reduction of 58.5% in DMF teeth for the children below the 7th grade as compared to 29.7% for the older children in the 7th and higher grades.

DMF Permanent Teeth Per Child

| Age | Aurora 1945-46 | Grand Rapids 1944-45 | Grand Rapids 1951-52 | % Rdctn* 1951-52 |
|---|---|---|---|---|
| 5 | .05 | .11 | .05 | 56.0 |
| 6 | .28 | .78 | .26 | 66.6 |
| 7 | .71 | 1.89 | .84 | 55.2 |
| 8 | 1.04 | 2.94 | 1.58 | 46.5 |
| 9 | 1.52 | 3.90 | 2.04 | 47.7 |
| 10 | 2.02 | 4.92 | 2.93 | 40.5 |
| 11 | 2.67 | 6.41 | 3.67 | 42.8 |
| 12 | 2.95 | 8.07 | 5.89 | 27.1 |
| 13 | 3.09 | 9.73 | 6.60 | 32.2 |
| 14 | 3.64 | 10.94 | 8.21 | 25.0 |
| 15 | 4.54 | 12.48 | 8.91 | 28.6 |
| 16 | 5.19 | 13.50 | 11.06 | 18.1 |

*Percent reduction based on DMF rates in Grand Rapids, 1944-1945.

## Dean Hausman Becomes Engineering Consultant for Nussbaumer, Clarke & Velzy

Nussbaumer, Clarke & Velzy, Inc., Engineers, announce that Dr. Erich Hausmann, formerly Dean of Engineering at Brooklyn Polytechnic Institute, is now consultant to the firm.

Dr. Hausman, at B.P.I. from 1915 to 1953, has been Professor of physics and electrical communication, Dean of Graduate Study, and Dean of the College. He is author, joint author, or editor of twelve texts in the fields of electricity and electrical engineering.

The New York office of Nussbaumer, Clarke & Velzy, Inc., has been moved to 500 Fifth Avenue, New York 36, N.Y.

# An Approach to Action on the Industrial Waste Problem*

## A Report on the Program of Naugatuck Chemical

*by* WALTER E. WILLIAMS, *Sanitary Engr., Naugatuck Chemical Div., U.S. Rubber Co., Naugatuck, Conn.*

OUR program at Naugatuck Chemical is progressing satisfactorily but as yet we have not advanced to a point to merit a scientific report. The writer proposes to outline a general approach to industrial waste problems, and to discuss a little of the thinking behind the approach.

The first step in any approach is to collect factual information (by sampling the industrial processes, the outfalls and the receiving waters), and to accumulate engineering and historic data. While this is an obvious beginning and a simple principle for those assigned the task, it often is a formidable undertaking.

This comment is particularly true of Naugatuck Chemical in Naugatuck, where three adjacent plants are operated. These include a chemical plant, a synthetic rubber plant and a rubber reclaiming plant. To further complicate and diversify the problem, the chemical plant alone consists of about twenty-five major processing units—manufacturing between 200 and 300 products and utilizing 300 to 400 different raw materials. Our production of rubber chemicals, agricultural chemicals, plastics, heavy chemicals and other miscellaneous products results in a number of unrelated waste patterns. After several years of preliminary work and nine months of intensive study, we are only now beginning to really understand the problem.

We are all conscious of the need for proper study, yet we all recognize that a study in itself does not abate pollution. The actual abatement of stream pollution is often a most difficult problem for all of us in this field, but one which we must firmly resolve to accomplish. It is our job as sanitary engineers to weigh the facts and provide an effective and reasonable solution in each situation. In no case is it our job to condone pollution, neither is it our place to dramatize the problem.

Management in general is aware of the need for stream pollution abatement. The fact that water conservation legislation is being passed at all levels of government is evidence of public concern over the matter. It is apparent that many major industries are making serious attempts to meet their pollution abatement obligations, as well as other civic and social responsibilities. This recognition and activity falls under the broad meaning of public relations—a philosophy that places the public in a position of primary importance in any decision. Progressive management is now deliberately adopting this policy through understanding and enlightenment. There is an earnest desire to prove that "bigness" and "badness" are not synonymous in business.

The interest and support of management must be sincere, positive and continuing in order that any industrial waste program will be successful. However, the problem of assuring the public benefits of pollution abatement, without jeopardizing the numerous other responsibilities of industry, is that of the sanitary engineer. To make full use of investments in industrial waste treatment, and to keep investments to a minimum, certain authority must be delegated by management to an industrial waste department. The authority should include such items as controlling the dumping of batches, enforcement of good housekeeping, and the timing of seasonal or intermittent production schedules, in order to reduce pollution loadings. To minimize the pollution problem, constant education and police activities are a large part of the job of a sanitary engineer in industry.

**The subject of product recovery:**

***"Most industrial plants already are recovering materials—where the recovery proves profitable."***

### A Major Problem

One of the biggest difficulties faced in any program is the gearing of industrial waste problems to industrial thinking and economy. Before attempting to orient a program to business, it would seem reasonable to define first what business is, and what it is not. By definition, one of the functions of business is to make a profit—without which no enterprise can long exist. A second function is to make available products and services which will add to the well-being of humanity at lower costs. It is difficult to evaluate the relative importance of these basic functions since they are interdependent. No matter what the ambitions of the owner, business today cannot be prosperous if it accepts only one of these functions. Although business does have social responsibilities, it is not basically an agency concerned with benevolence or charity.

Both industries and municipalities must be practical in approaching their problems, but a different kind of thinking is required in each case. The engineering procedures in industry are well known: when the problem is clear, the classic steps of waste prevention, recovery and treatment must be weighed and investigated. In existing industrial plants, waste prevention is somewhat limited by large investments in existing facilities. However, education and housekeeping can do much to minimize the problem. The most significant possibilities with respect to prevention lie in the proper location of new plants and processes. Forethought can do more toward the protection of our water resources than any other factor.

The subject of product recovery has been greatly publicized and is certainly important. Perhaps we hear a little tob much of the spectacular results in some industries. On the whole, recovery is a difficult problem. Most plants already are recovering

*A paper presented at a meeting of the New England Sewage and Industrial Wastes Assn., and released for publication in *Water & Sewage Works*.

materials where recovery proves profitable. Thus, in considering industrial wastes, the materials remaining as possible items for recovery are either those difficult to recover or those with an uncertain economic status. In plants where many diversified products are manufactured in relatively small quantities, the recovery problem becomes increasingly difficult and impractical. Normally, recovery must be on a large scale to be feasible. Although recovery is an ideal solution to an industrial waste problem, it is the exception and not the rule. We should not create the general impression that through recovery, industrial pollution abatement can be made self-supporting or profitable.

### Waste Treatment Considerations

After the preventive and recovery measures have been crystallized, then the problems involved in waste treatment take shape. In most cases, industries represent special problems which must be solved from fundamentals. Time and study are required for laboratory experimentation and pilot plant work. From the data accumulated, a basic overall treatment plan should be developed; however, the plan of attack should be stepwise. The goal of a waste treatment program is not the construction of a spectacular treatment plant. Success should be measured not by the size of treatment facilities constructed, but rather by improvement in the condition of the stream.

Every practical consideration indicates the careful stepwise approach as ideal. Most industrial problems include several unknowns which often are interdependent. The construction of a treatment plant to answer all of the stream needs at one time, often involves too many risks with respect to investments required. Industry cannot afford "white elephants" in the unprofitable field of industrial waste disposal.

### Financing Waste Treatment

The financing of an industrial waste program calls for a different kind of a plan than does municipal financing. Municipalities usually seek funds for investments at one time so they do not have to return periodically to the taxpayers for more money. This is a logical plan, since engineering skills have progressed to the point where domestic sewage problems generally can be solved all at one time, and the system of financing spreads the costs to the taxpayer over a period of years.

***"It should be remembered that capital invested in industrial waste treatment not only does not show a profit, but also represents an equal sum that cannot be invested in a profitable enterprise."***

Industrial waste problems are not standardized and hence, installations must be financed from working capital. This capital must be derived from profits; and under present conditions of high taxes, high carrying charges for inventories, and regulations affecting business, most industries are finding it more and more difficult to raise capital. For this reason the stepwise approach is better fitted to industrial financing through the distribution of investment over a period of years. It should be remembered that capital invested in industrial waste treatment not only does not show a profit, but also represents an equal sum that cannot be invested in a profitable enterprise. Therefore, if a choice of financing exists between facilities having a slightly lower operating cost but a higher investment cost and vice versa, it may prove more expedient to choose the facility resulting in lower investment and higher operating costs.

Another consideration which affects the selection of lower investment plans is the diversification of some industries. They are never sure of next year's problems. It is entirely possible for a product to be discontinued suddenly because of the development of a better product by another company. Many unforeseen developments can completely change the nature of an industry's waste problems. In view of the unknown direction of future industrial waste treatment requirements, it does not appear wise to include any sizable capacity for expansion in industrial waste treatment facilities. Flexibility should be a guiding factor in selecting units to facilitate future changes; however, the control of new waste is more within the realm of the development department than the industrial waste department. The only place expansion should be seriously considered is in the sewer system, and there liberal capacity for growth should be included. Industrial waste programs should be such that they continually are catching up with or keeping abreast of new problems; we can anticipate but cannot predict the future.

**The goal of a waste treatment program:**

***"Success should be measured by improvement in the condition of the stream."***

### Additional Answers Needed

Although not an immediate problem at our plants, I have a sincere hope that some treatment better than trickling filters will be found for reducing the B.O.D. of industrial wastes. These units generally are not suited to an industrial economy because of the large investment required, especially when only partially successful treatment results can be accomplished. This hope may be in the same category as our never-ending discussions about the inadequacies of the B.O.D. test, yet we must continue to look for a better answer.

It is clear that the abatement of pollution at existing plants takes time. The time which each industrial plant is allowed to control its problem varies with a number of factors:

1. The uses of the stream
2. The condition of the stream
3. The activities of other industries and municipalities in the vicinity
4. The activities of competitive industry elsewhere

The first two factors probably are the most important. In any case, an industry must weigh the *desirability* of beginning a logical stepwise approach directed toward prevention of a critical situation against the *necessity* and *responsibility* for taking faster action if its problem is allowed to become a real nuisance.

I have tried to present as clearly and concisely as possible my thoughts on facing an industrial waste problem and solving it in a positive and reasonable manner. It is felt that we in industry can produce the best results through considered and persistent action.

## Third Sewage Works School in State of Washington

The Third Biennial Inland Empire Sewage Works School will be held at The State College of Washington, Pullman, Wash., on May 14-16, 1953. Communications should be addressed to G. H. Dunstan, Professor of Sanitary Engineering, The State College of Washington, Pullman, Wash.

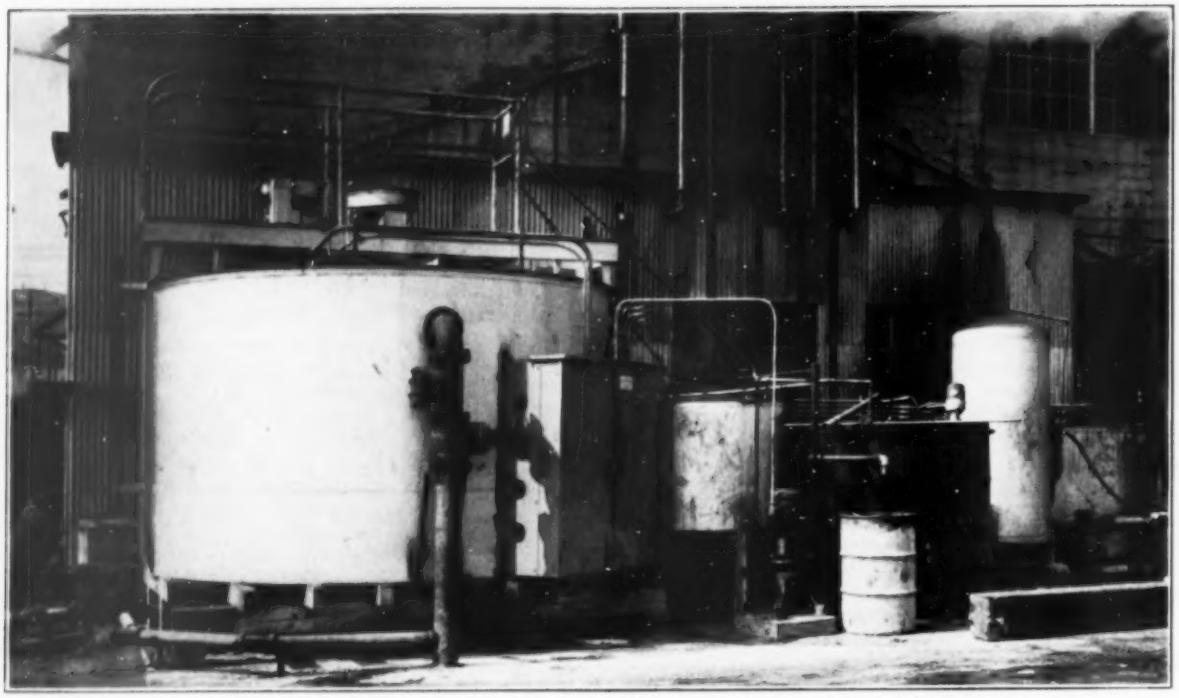


Fig. 1—PROCESS Flotator-Clarifier installation. Waste water is re-used as described in text.

# The Why and How of Treating Rendering Plant Wastes

## In Which New Flotation Process Provides Water Re-use; Heat Conservation and By-products Recovery

*by* L. S. FARRELL, *Manager, Flotation Div., Process Engineers, Inc., Los Angeles, Calif.*

THE treatment of wastes discharged from rendering plants and meat packing plants may be considered as one problem. These wastes are closely similar in composition, and the two industries involved are jointly interested in solving treatment problems.

Wastes from both industries contain principally fats and proteins in the free and emulsified state. (From the standpoint of treatment, this is fortunate, as will be discussed later.) Packing plant wastes will usually present a more serious problem of treatment than will rendering plant wastes: This is because they contain more or less blood from the kill floor, as well as manure from the stockyards and evisceration process, and have a much higher relative volume of flow per ton of end products.

This paper by Mr. Farrell was presented at the 19th convention of the National Renderers Association, San Francisco, Calif., and is published in *Water & Sewage Works* with the permission of the Association.

### Why Treat Wastes?

Before discussing the actual *process* of waste treatments, we will first review the reasons for the *practice* of waste treatment. The basic reason for treatment of wastes from any industry is probably to accomplish one or all of the following purposes:

1. Pollution Control
2. By-Products Recovery
3. Water Conservation

### To Control Pollution

Of these three reasons, probably the first is of most immediate significance because of the "pressure" being applied by local, state, and federal authorities. Many of our states have had statutes for 50 years and more, prohibiting pollution of our streams by "waste matters." It has not been until very recent years that the authorities have been granted police powers to enforce these regulations.

Transmittal of certain water borne diseases from man to man, and even animal to man, is possible through the medium of public water supplies having their source in polluted streams. Modern methods of water purification have largely eliminated or reduced the incidence of water borne diseases in man, although the authorities still are concerned over

the degree of pollution existing in the streams used as a source of domestic water supplies by many of our cities. Of special concern to the rendering and meat packing industries is the possibility of transmitting disease from animal to animal through infected drinking water. It is possible for bacteria, viruses, and parasites from infected animals to survive in the waters of streams accessible to livestock at watering places. Thus, the discharge into streams of wastes containing paunch manure, and washings from viscera and hides, may account for epidemic diseases in livestock.

The public health authorities are further interested in pollution of our streams and lakes because of its affect on the utility of these waters for recreational purposes. Waters used for swimming or bathing should be—bacteriologically—essentially of drinking water quality. For this reason, swimming is prohibited in certain streams and ocean beaches because of existing gross pollution.

State Fish and Game Commissions are concerned with stream pollution as it affects the survival of fish and wild life, commercially as well as recreationally. Organic matter from municipal and industrial wastes may deplete the dissolved oxygen in streams or lakes, preventing the survival of game fish therein.

A good example of extreme pollution is the Mississippi River. Some 25 years ago the writer was privileged to take part in a pollution survey of this river below the Twin Cities of Minneapolis and St. Paul, Minn. For many years the domestic sewage from these cities, along with wastes from a number of meat packing and processing plants, was discharged to the river without treatment. Solids settling to the bottom, especially behind dams and at points of low flow velocities, became septic and produced gases which floated large masses of solids to the surface. Within the limits of the two cities, bathing was unsafe. Even rough fish such as carp could barely survive.

Some 40 miles below St. Paul, the river enlarges to form Lake Pepin, which is 2 to 5 miles wide and 25 miles long. At one time this lake had been a famous resort center, noted for its boating, bathing and fishing. Commercial shell fishing had been a profitable industry. All these were at that time a memory of the past, due to the state of gross pollution existing. However, since the construction and operation of adequate waste treatment facilities, the river has now "come back" and its recreational and commercial value has been restored. As many rendering and meat packing plants are located along streams (for past convenience in disposing of waste flows) the concern of health authorities with their pollution problem can be realized.

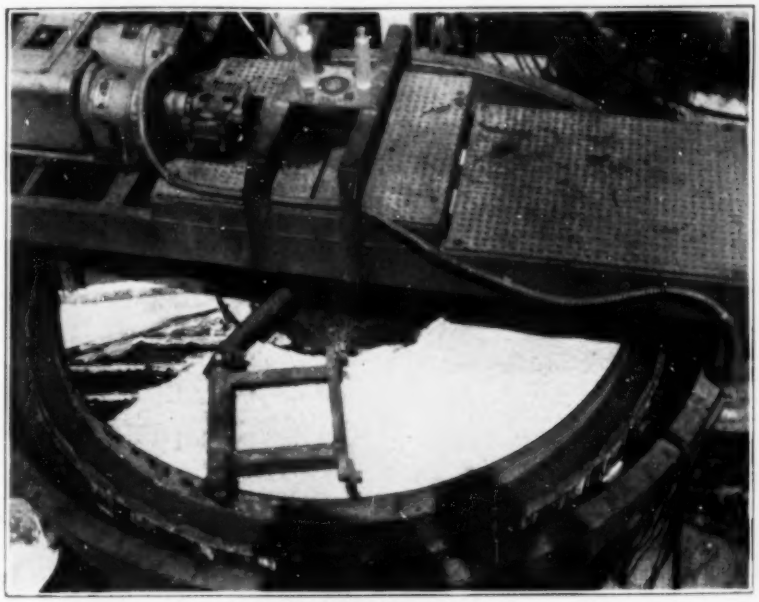


Fig. 2—PROCESS Flotator installation
Thick layer of floated fats and proteins (lower left) discharged by skimming arms

Stream pollution is just one of the aspects of the problem. Where wastes are discharged to municipal sewers, grease and solids deposited in the lines can cause stoppage of flow, with resultant costs for sewer cleaning, and even temporary shutdown of the industry. The initial and operating costs of sewage treatment plants are proportional to the "strength", as well as the volume of wastes to be treated; thus, the local authorities, responsible for the construction and operation of treatment plants are involved.

### To Recover By-Products

The second reason given for treatment of wastes, and that probably of most significance to this industry, is the potential recovery of fats and proteins from waste flows. It has been proven that, with the most modern processes available, the value of these recovered materials can amortize the initial cost of equipment; and in many cases show a sizable return on the investment. Actual figures on the economy of waste treatment will be given later in this paper.

### To Conserve Water

While the third reason for waste treatment, water conservation, may not seem of importance at the moment, it should be given serious consideration. Our natural water resources, both surface and underground, especially those available at or near metropolitan areas, frequently are depleted—we might even say exhausted. Industry can no longer "drill another well" or even have installed a larger water line and meter from a municipal water supply. In coastal areas, as well as inland, it would seem practical to utilize waste waters to the fullest extent (by treatment and reuse) rather than to undertake the expense of going hundreds of miles to available sources, or even considering use of treated sea water as a source of water supply.

The actual use of water for drinking purposes is less than ½ of one per cent of our total water consumption. Why then should it be necessary to provide water of drinking quality for the other 99½ per cent of water used? Although there are hazards involved, it is conceivable that some day our larger cities, at least, may have two separate distribution systems: one for drinking water, and one for other domestic and industrial uses.

An example of extreme water conservation exists along the Ruhr Valley in Germany. Much of the drinking water, as well as that used by industry, is obtained from the Ruhr river. Slow sand filters and

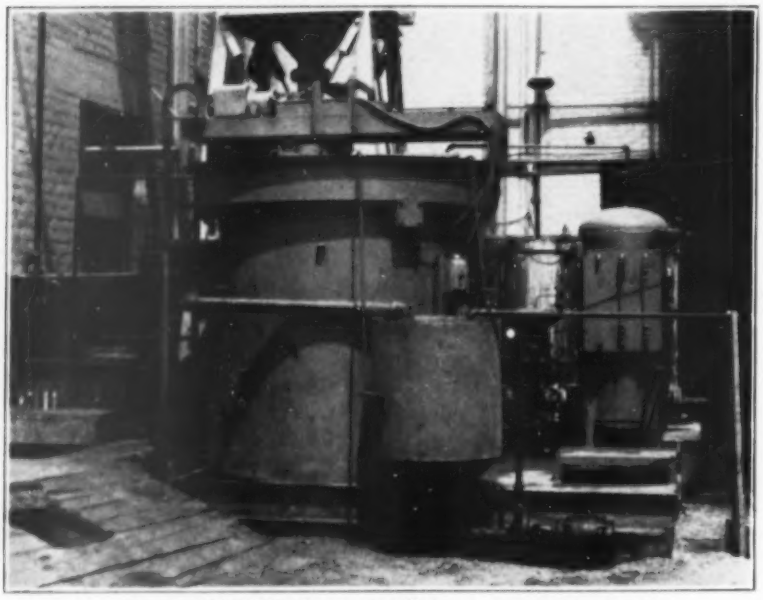


**Fig. 3—COMPLETE Flotator installation is a compact system Text describes the function of each unit**

chlorination are used for purification. Industrial water, after treatment by the industry, is returned to the river. Only domestic sewage, after treatment, is discharged to another watercourse. Although hard to conceive, there are hydro-electric plants generating power in the daytime for peak industrial use, and at night pumping the water back "upstairs" for re-use the following day. During dry seasons, water from the Rhine River is pumped back to the upper Ruhr Valley to maintain certain minimum flows and to assure adequate supply for municipal and industrial uses.

In a related industry, a prominent soap company, planning to construct a plant in southern California, found that insufficient fresh water was available for its needs. However, by installation of an efficient system of waste water treatment, the industry is operating, saving several million gallons of water daily, as well as recovering valuable fats and oils from these flows. In San Francisco, the Western California Products Co. (see Fig. 1) is re-using treated waste water in barometric condensers and in a hasher-washer. In the Los Angeles area, the Luer Packing Co. is using treated waste water for the same purposes, thereby reducing the demand on their well supply.

Where wastes are disposed of to the sewer, many cities charge industry on the basis of volume and "strength" of these wastes. Thus, by treatment and re-use, the costs of disposal to the sewer can be materially reduced.

## Waste Treatment Processes

Processes for the treatment of rendering and meat packing wastes fall into two general classifications: primary, and primary plus secondary treatment. Primary treatment can include fine screening, plain sedimentation (such as in a conventional catch basin, cess pool, or septic tank) and a relatively new process known as pressure flotation.

Secondary treatment, necessary only when a very high degree of treatment is required, can be accomplished either by biological filtration or the activated sludge process. As efficient primary treatment of rendering wastes will, in most cases, produce an effluent acceptable by the authorities for disposal to stream or sewer, we will confine our discussion to that treatment.

### Treatment by Settling

The conventional catch basin may provide ample treatment if it is large enough to give a detention time of at least 30 minutes *at peak flows*, and if the wastes contain a low percentage of emulsified fats and proteins, such as tallow wash water and caustic cleanup waters. If recovery by hand skimming is practiced, the labor involved, plus the increase in fatty acids due to infrequent skimming, must be considered.

If recovery of waste fats is not an item, mechanical screening, with a vibrating or rotary type fine mesh screen, can provide, in many cases, the most economical answer to the problem. If this method is used, it is desirable to deliver to the screen a mixture of all grease flows with manure from the hasher-washer and hand cleaning operations. The manure acts as an absorbent and filter aid for the grease, helping to keep the screen clean, and producing a better effluent.

### Treatment by Pressure Flotation

The pressure flotation system for treatment of rendering and meat packing wastes has proven to be the most efficient method of primary treatment for by-products recovery, pollution control, and water conservation. As mentioned earlier, rendering plant wastes, containing principally fats and proteins not in true solution, are ideally suited for highly efficient treatment by coagulation and flotation. Pressure flotation installations are shown in Figs. 1 and 2.

The theory of pressure flotation is based on the fact that the amount of gas which a liquid will dissolve is directly proportional to the absolute pressure thereon. For example, at sea level and a temperature of 70° F, water will dissolve approximately 2 per cent of air by volume. At 15 lbs. pressure, the solubility is approximately 4 per cent, at 30 lbs. 6 per cent, etc.

When the pressure is released to atmosphere, the volume of air or gas present, above saturation, is released, leaving the solution in the form of extremely fine bubbles. These bubbles attach to suspended matter present in waste waters, and carrying these solids to the surface as "float" for removal by skimming. This action may be compared to mechanical screening, with the rising mass of bubbles corresponding to a screen with an infinite number of infinitely small openings.

To assist in removal of solids present in an amulsified condition, a coagulant such as alum is introduced to the waste flows. Where an efficiency of 70 per cent may be expected using air alone, grease recoveries of 95 per cent or more may be obtained by use of coagulants.

### The Flotation Process

A typical pressure flotation system installed by Process Engineers, Inc., is illustrated in Fig. 3. It consists essentially of the following:

1. Catch basin
2. Process pump
3. Retention tank
4. The flotation unit
5. Coagulant feeding system
6. Controls

The catch basin is utilized to blend

all waste flows containing grease and recoverable proteins. The capacity of this need not exceed 10 minutes storage at peak flows. Sanitary sewage and manure should be handled separately to avoid contamination of recovered by-products. For this reason, the gut hasher should be provided with a shallow basin which includes a skimming baffle. Manure is retained behind this baffle, and greases overflow to the catch basin.

A pneumatic control device is installed in the catch basin on the downstream side of the skimming baffle. This controller functions to adjust waste flows and coagulant feed in proportion to volume of waste flows.

The flow is from the catch basin into the process pump, air and coagulant being added in the suction line; through the flow control valve; thence into the retention tank where undissolved air is liberated. The discharge side of the retention tank is provided with a back pressure valve and control to maintain pressure for solution of air.

Leaving the back pressure valve, the flow enters the Flotator at atmospheric pressure, where the dissolved air is liberated, carrying solids to the surface as "float," for removal by the skimming arms. The Flotator is so constructed that the wastes must travel a maximum distance at minimum velocities, to give a "float" with a minimum moisture content. The mechanism driving the skimming arms also operates sludge rakes, for collection of heavy solids which may settle. The clarified water flows under the scum baffle, then up and over a circular V-notched weir, for disposal or reuse in barometric condensers and the hasher-washer.

Where maximum solids removal is desired the Flotator is replaced by the Flotator-Clarifier, as shown in the photograph, Fig. 4. In this unit flotation and grease recovery takes place in the center compartment, with flow thence into a settling compartment for removal of any solids not reclaimed in the "float."

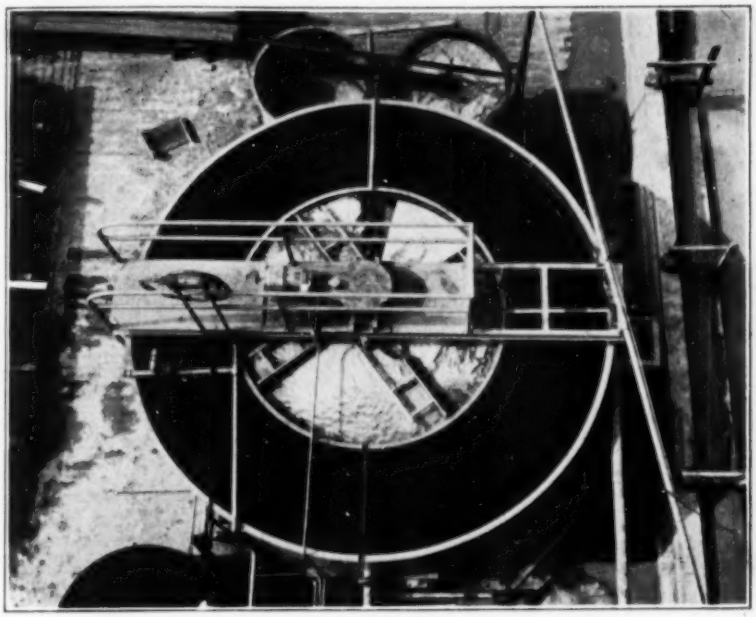


**Fig. 4—TOP VIEW of Flotator-Clarifier concentric units**
**Absence of scum in clarifier section indicates high efficiency**

Table 1
PROCESS PRESSURE FLOTATOR
Peterson Manufacturing Company
Los Angeles, Calif.

Flotator Skimmings

| Date | Moisture | Moisture Free Basis Crude Protein | Crude Fat |
|---|---|---|---|
| 4-30-52 | 90.75% | 23.88% | 56.7% |
| 5-16-52 | 92.45 | 19.38 | 60.8 |
| 5-29-52 | 89.4 | 19.38 | 58.5 |

Efficiency in Fat and B.O.D. Removal

| Date | Total Fat Influent | Effluent | Removal |
|---|---|---|---|
| 5-16-52 | 3830 ppm | 270 ppm | 93% |
| 5-28-52 | 4300 ppm | Nil ppm | 99% |
| | 5-Day Bio-Chemical Oxygen Demand | | |
| 5-28-52 | 6800 ppm | 470 ppm | 93% |

Above analyses indicate a recovery of 40 pounds combined fat and protein per 1000 gallons treated.

Table 2
PROCESS FLOTATOR-CLARIFIER
Following results obtained at a West Coast meat packing plant, killing and cutting operation only.

| | Influent | Effluent | Removal |
|---|---|---|---|
| Grease (ether-soluble) | 4360 ppm | 170 ppm | 96% |
| Suspended Solids, ppm | 6270 | 440 | 93% |
| Biochemical Oxygen Demand-5-day, 20° C. ppm | 3230 | 1480 | 54.5% |

Above analysis indicates a recovery of 35 pounds of grease per 1000 gallons treated or a total of 1675 pounds per 8-hour day.

## Removal and Recovery

Laboratory analyses shown in Tables 1 and 2 indicate the high efficiency in removal of grease, suspended solids and B.O.D. which can be obtained by use of the pressure flotation system. Only a detailed study of each individual plant, involving determination of waste volume, the amount of solids and organic matter contained therein, and the degree of treatment desired or required, indicates whether or not additional facilities are necessary.

It is hoped that the information contained in this paper will assist in better understanding the concern of authorities with the necessity for treament of rendering plant wastes, and in arriving at the most practical and economical solution of the problem.

## Distilled Water from the Faucet

The public is now being offered small household size ion exchange units which the ads state "will convert ordinary faucet water into distilled water for use in steam irons, filling storage batteries, or any other use for which distilled water is needed." One such unit is offered under the name "Distillo." Replacement cartridges of the amber-like resin are offered at 59 cents each; the original unit with cartridge sells for $1.98.

In case you are interested, the firm whose announcement of the above unit we have just noted in a Sunday paper is the Ionex Corp., 848 Washington Bldg., Washington 5, D.C.

Not that we are out to kill any sales of these household de-ionizers, but for the small quantity of demineraized water needed in the average home we suggest another source. In defrosting home freezers or refrigerators the ice or frost removed from the freezing unit converts into essentially distilled water when melted. Why not?—it is nothing but frozen water vapor. By the same token the water that drips from sweating water pipes is practically distilled water.

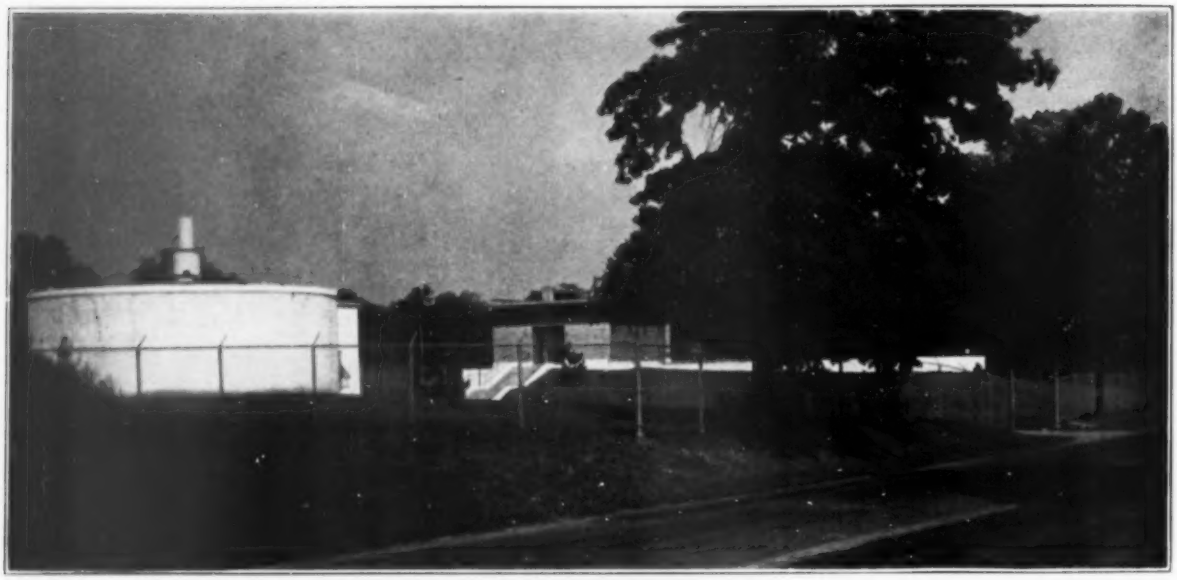


Fig. 1—SUGAR CREEK PLANT at Kirkwood, Mo. Capacity 0.6 mgd.

# Impingement Aeration at Kirkwood, Plants

## Simplicity of Control and Efficiency of Treatment Demonstrated in Two Small Sewage Plants

*by* JOE KRUEGEL, *Superintendent of Disposal Plants, Kirkwood, Mo.*

KIRKWOOD, Missouri, a community having a population of 18,640, lies about seven miles west of St. Louis. The first sewage treatment plant, constructed in 1934, was known as No. 1 Sugar Creek West Side Plant. It employed the activated sludge process, and included hopper-bottom primary and final settling tanks, three mechanical aerators in square tanks, one fixed cover rectangular digester, and sludge beds.

A second activated sludge plant was built on the east side of town in 1935. This was known as Plant No. 2, or the old Leffingwell Street Plant. It was similar in construction to the Sugar Creek Plant. Both plants became badly overloaded as the population of the town increased.

After World War II, it became evident that new and larger sewage treatment facilities were needed. Accordingly, in 1948, plans were drawn for two new plants—the new Sugar Creek and Leffingwell Plants (Figs. 1 and 2). Construction of these plants was begun in late 1949, and they were placed in operation in the summer of 1951. Leffingwell No. 2 plant was constructed about 250 ft. northeast of the original plant site and the Sugar Creek Plant was located on Highland Avenue, one-half mile west of the city limits in order to better serve the west side.

### Two New Treatment Plants

The two new plants are similar in design and layout. However, the Leffingwell plant was designed for a maximum flow of 0.9 mgd, whereas the maximum design flow at Sugar Creek was 0.6 mgd. Each plant has the following structures: Aerated grit removal unit; comminution device; two primary and two final rectangular settling tanks, each mechanically cleaned; two rectangular aeration tanks; sludge digester with floating cover, external sludge heater and sludge recirculating facilities. The Leffingwell Plant No. 2 uses the original fixed-cover digester of the old plant for secondary sludge digestion. At both plants digested sludge is dried on sand beds.

The general operation of both plants has been made highly successful by certain improvements and additions to the original equipment. The final tanks of the new plants had no influent baffles, but after the plants had been in operation a relatively short time, it was discovered that considerable short circuiting occurred and that a heavy carry-over of sludge into the effluent weirs took place. Final tank influent baffles have now been installed and the operation is satisfactory. It was also found necessary to install larger (6-in.) sludge draw-off valves, as the original lines (3-in. diam.) were continually becoming clogged—making sludge withdrawal a difficult and uncertain procedure. Naturally, inability to withdraw sludge properly from the tanks added to the early operation difficulties.

The blowers used at these plants

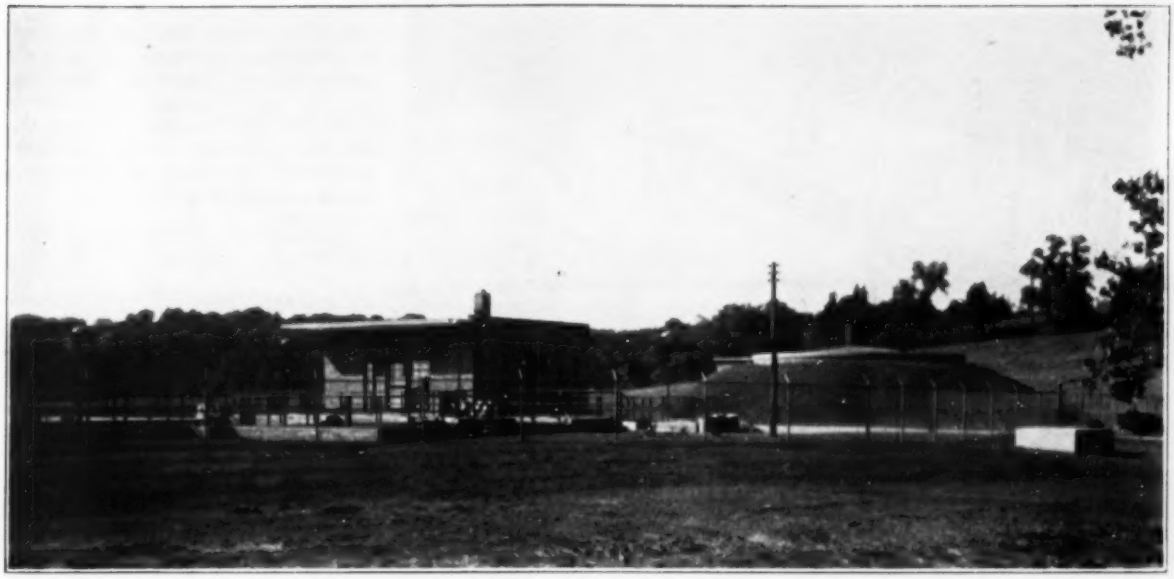


Fig. 2—LEFFINGWELL NO. 2 PLANT. Kirkwood's 0.9 mgd plant

are horizontal, positive-displacement, electrically driven units located in a control station (see Fig. 3). At the Leffingwell No. 2 plant there are two Roots-Connersville blowers, rated at 1.37 cu. ft. per revolution. Each blower is driven by an Allis-Chalmers two speed, 20 to 30 HP motor. Each of the blowers develops 475 cfm at low speed and 725 cfm at high speed. These blowers supply air to Walker Impingement Type aeration units in activated sludge tanks and grit chambers. The aeration units in the grit chambers inject approx. 50 cfm of air.

## Nature of Sewage Treated

The raw sewage treated at these plants has a B.O.D. higher than that normally found at plants of this size. There are no industrial wastes of any significance discharged into the sewer system. However, many of the trunk sewers are laid on very flat grades (in fact, one sewer actually was laid in such a manner that the sewage must flow up-hill). Consequently, the velocity of flow in the sewers is low and sewage arrives at the plant in a septic condition. This situation has existed for a number of years.

Since the new plants were placed in operation, they have been plagued by receiving quantities of free oil which created a most difficult operating problem. The source of free oil finally was located and eliminated from the sewers, thus greatly reducing early operation difficulties. The amount of air required for aeration

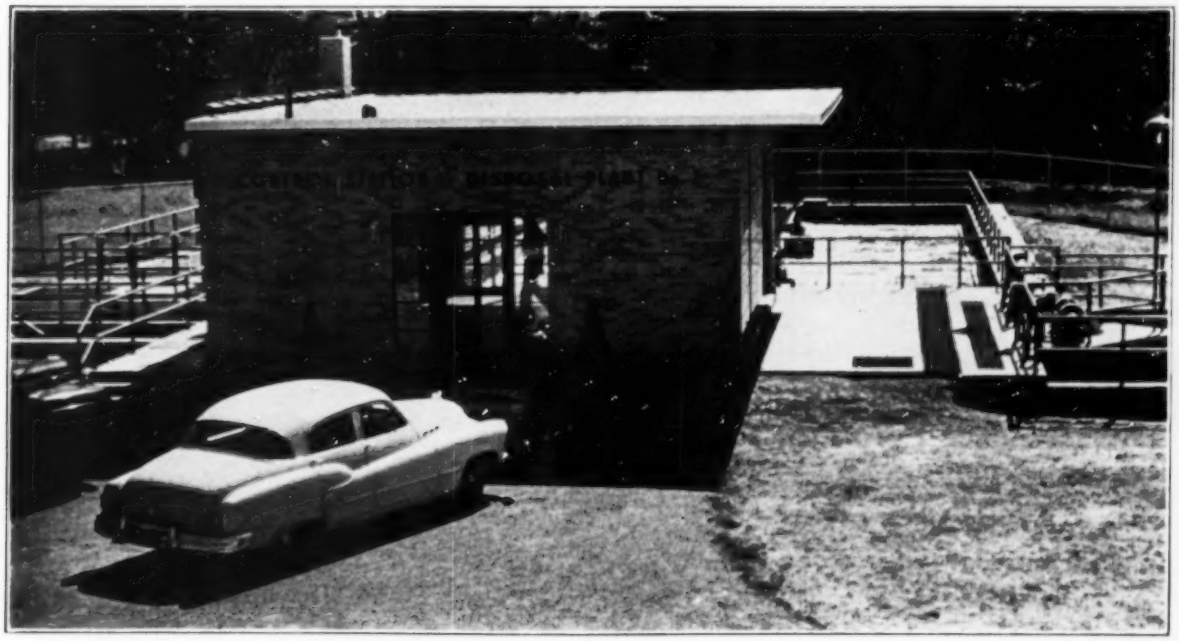


Fig. 3—CONTROL STATION, Leffingwell No. 2 plant, houses blowers and laboratory

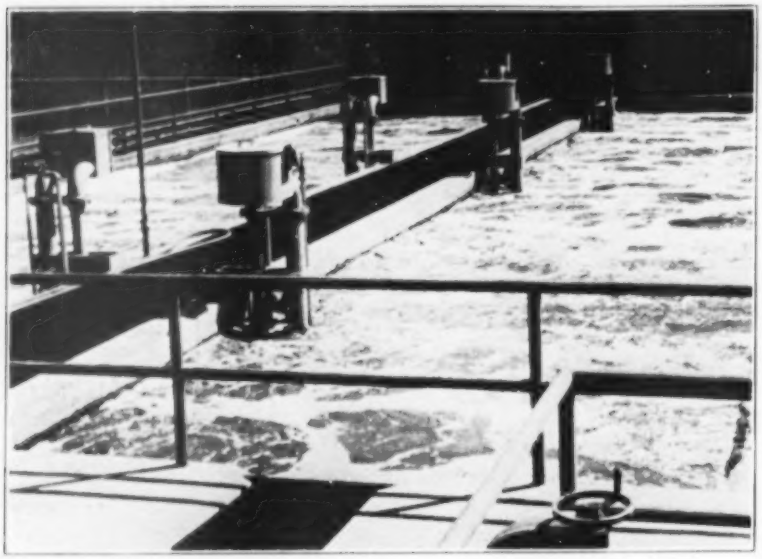


Fig. 4—AERATION UNITS illustrate operation of Impingement Aerators Leffingwell No. 2 plant

has dropped markedly; the amount required is now approx 0.5 cu. ft. per gal. of raw sewage treated.

### Control Tests and Records

The tests and analyses required for proper operation and maintenance of activated sludge plants are performed, and daily records are kept. Tests are conducted in accordance with *Standard Methods*, and include the determination of B.O.D., suspended solids, pH, dissolved oxygen, total daily flow, and mixed liquor and return activated sludge solids. Records are maintained of quantity of air used, volume of sludge pumped and pertinent digester data. Records of weather conditions, temperature of the air, and of the raw sewage, are also maintained. All laboratory samples are collected between the hours of 8 A.M. and 5 P.M. each day. Samples are weighed to make up representative daily composites. Although the plants have been in operation for only one year, the following average data will give an indication of the excellent results being obtained. (These data are from the Leffingwell Plant.)

| | |
|---|---|
| Raw sewage B.O.D. | 328 ppm |
| Raw sewage susp. solids | 284 ppm |
| Final effluent B.O.D. | 12.1 ppm |
| Final effluent susp. solids | 15.8 ppm |
| Overall B.O.D. removal | 96.3% |
| Overall susp. solids removal | 94.5% |
| Average flow | 0.78 mgd |

### Impingement Type Aerators

Each of the plants is of conventional design. The aeration equipment is of the most recent type, in that porous plates or tubes are not used. Since many inquiries have been received with reference to the performance of the aeration equipment, it will be described in detail.

The aeration equipment, supplied by Walker Process Equipment Inc., Aurora, Ill., is known as the "Impingement Aerator" type. This equipment combines a multiplicity of nozzles which jet recirculated tank liquor upon saucer-like bowls located directly beneath the nozzles. The tapered cast iron nozzle, bolted to the liquor header, has a ⅝-in. diam. outlet. The impinger bowl, about 3-in. diam., has a small raised tip located in the center, and four air outlet holes in the sides. The impinging jet of liquor produces a cavitation effect; thus dividing the air into very fine bubbles, slightly smaller than those normally produced in sewage aeration.

Impingement liquor, taken directly from the aeration tank contents, is pumped by air lifts which are an integral part of the aeration equipment. The arrangement of the airlifts and aeration piping is shown in Figs. 4 and 5.

An important feature of the air lifts is that they permit the direction of liquid flow to be easily and readily reversed. Reversal causes liquor to flow backwards through the tapered nozzles and effectively remove any temporary clogging. As a part of regular operating routine at the Kirkwood plants, the aeration system is back-flushed for five minutes once every 4 to 6 days. The operation is simple, requiring only the closing and opening of two small valves and allowing the air lift to operate in reverse. Usually, by the time the operator has completely reversed all air lifts (there are six such units at Leffingwell and four at Sugar Creek), sufficient back-flushing has been accomplished at the first air lift reversed. The operator then makes another round, manipulating the air control valves and placing the air lifts back in normal operation. The air supply to the units is not shut off during the back-flushing operations, and aera-

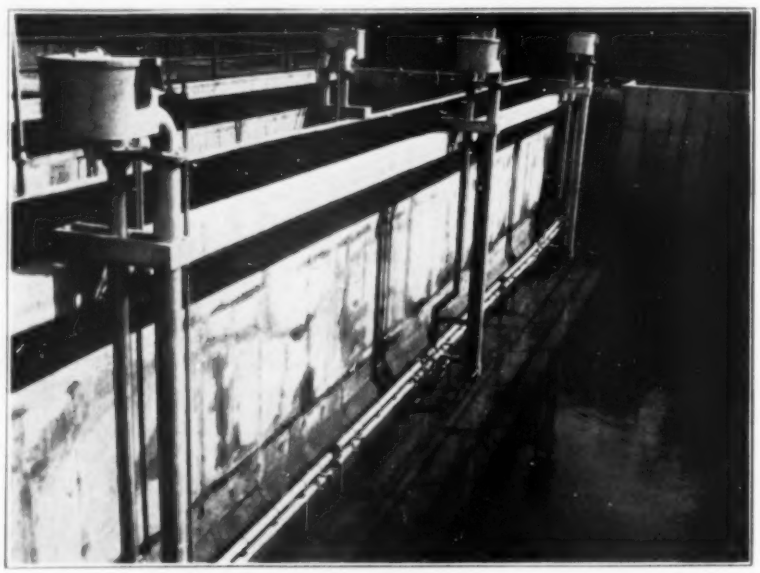


Fig. 5—EMPTY aeration unit reveals air lift and piping arrangement Leffingwell No. 2 plant

tion continues without interruption. Thus, it is not necessary to de-water units or to remove equipment in order to clean nozzles or air outlet ports.

It has been necessary to de-water the entire plant as a result of electric power outages of 6 to 8 hours or longer. These failures caused septic conditions to occur in the entire plant, since no aeration or sludge removal could be accomplished. In one case, as stated earlier, the sudden discharge of several hundred gallons of fuel oil into sewers completely stopped operation of the plant. During the time that aeration tanks were empty, careful check of the air diffusing equipment showed clogging of nozzles or air ports had not occured. This is an important advantage because the cleaning of porous tubes or plates may be a problem not easily handled, particularly in smaller plants such as these at Kirkwood.

With the system now in use at both plants, air filters are not required. Back-pressure on the blowers does not increase over a period of time, thus indicating that there is no gradual clogging of air ports.

No clogging problems have been encountered in the nozzles or air ports of the grit chamber, even though there is much more solid material present in the raw sewage than in the mixed liquor—material that could act to foul the air ports or nozzles. In the case of the grit chamber aerators, impingement water is obtained from settled final effluent before it passes through the Parshall flume. This rather unique arrangement works to advantage: there is sufficient head available between the final tank water level and the grit chamber water level to provide sufficient nozzle pressure in the grit aeration equipment. In addition, returning the final tank effluent tends to freshen the sewage as it enters the grit chamber.

**Acknowledgment**

The consulting engineer for the plants for the City of Kirkwood was William C. Barry and the consulting architect was Frank L. Thompson, both of St. Louis, Missouri. The general contractor for the Leffingwell plant was J. E. Latta Company and for the Sugar Creek plant, Alberici Construction Company, both of St. Louis, Missouri. C. L. Temme is city engineer and both plants are under the direct supervision of the writer.

## pH Value is 14 Million Dollars

Do you have an electronic pH meter in your water, sewage, or industrial waste plant laboratory? If so, you may have contributed to the growth of an energetic young industry. An article in *Barron's Weekly* terms Beckman Instruments, Inc., "a small but growing manufacturer of analytical devices used by science and industry," and notes that "in the calendar year 1952, sales totaled about $14 million."

The company was organized in 1934, when Dr. Beckman, then a chemistry professor at the California Institute of Technology, developed an improved pH meter to measure acidity and alkalinity in solutions. This product won such wide acceptance that these instruments now account for about 14% of total sales.

In 1940 the company developed its second product, the spectrophotometer, which speedily identifies the chemical substances that are present in a product sample. This item accounts for approximately 25% of current sales. Beckman's third principal product, developed in the same year, is a small potentiometer (Helipot), which was designed to aid the performance of the pH meter. Basically, this device converts mechanical motion into an electrical equivalent.

To make its products adaptable to a broader range of uses, Beckman also manufactures attachments and accessories, as well as replacement parts and supplies.

Of the 1,400 employees now on the payroll, 200 are directly employed in research and engineering. Since the war, research and development expenses have varied between 5% and 10% of gross sales.

## "Mr. Water Works"

Harry Jordan, Executive Secy. of the Am. Water Works Assn., was honored by his home section—the Indiana Section—during its annual meeting on Feb. 12, 1953. The occasion was Jordan's 50 years of service in the water supply field; the better part of which had been as Chief Chemist and Sanitary Engr., with the Indianapolis Water Co.

In recognition of his half-century of service and his home-coming, a "Harry E. Jordan Night" was staged. At the annual dinner Harry and Ruth (Mrs. Jordan) were the recipients of a handsome sterling tray, appropriately engraved, and many tributes were paid this native Hoosier, who has done so much for the water works industry—both before and since becoming Executive Secretary of the A.W.W.A.

After the dignified part of the ceremony, a little fun was the order of the evening, at which time Harry was knighted "Mr. Water Works," with fanfare, and the fire hydrant insignia noted in the accompanying picture was placed around his neck by Lewis Finch, Chief Engr. of the Indianapolis Water Co., and section representative on the A.W.W.A. Board, who was M.C. of the evening.

The accompanying photograph was made by John Kleinhenz, Director of Publicity, Indianapolis Water Co.

## The "Vanishing Killer"

In 1925 typhoid fever took 334 lives in West Virginia. In 1951 only two persons died with typhoid fever, representing a rate of but 0.1 death per 100,000 population. The W. Va. State Dept. of Health hazards a prediction that a year will occur when there would be no typhoid deaths in that state of 2,000,000 population.

W. H. Weir, director of water pollution control for the State Dept. of Health of Georgia, reports that there was not a single case of disease in the state during 1952 which could be traceable to any of Georgia's 400 public water supplies.

How far advancement in sewage treatment and improved operation of water purification plants can be credited with the two above records no one can positively say, but such records are ample proof that typhoid fever is definitely the vanishing killer. In this certainly water and sewage authorities, together with the sanitary engineering profession, deserve a large measure of credit.

# Engineer-Directors in Charge of Water Pollution Control Agencies

## State and Territorial

### Alabama
Arthur N. Beck, Director
Bureau of Sanitation
State Dept. of Public Health
Montgomery 4, Alabama

### Alaska
A. J. Alter, Director
Div. of Sanitation & Engrg.
Territorial Dept. of Health
Juneau, Alaska

### Arizona
G. W. Marx, Director
Sanitary Engineering Division
State Dept. of Health
Phoenix, Arizona

### Arkansas
F. L. McDonald, Chief Engr.
State Board of Health
Little Rock, Arkansas

### California
Vinton W. Bacon, Exec. Officer
Water Pollution Control Board
Sacramento 14, Calif.

### Colorado
W. N. Gahr, Director
Div. of Sanitary Engrg.
State Dept. of Public Health
Denver 2, Colorado

### Connecticut
Richard Martin, Director
State Water Commission
Hartford, Connecticut

### Delaware
Donald K. Harmeson, Director
Div. of Sanitary Engrg.
State Board of Health
Dover, Delaware

### Dist. of Columbia
Wm. H. Cary, Jr., Director
Bureau of Public Health Engrg.
Distr. of Columbia Health Dept.
Washington 1, D. C.

### Florida
D. B. Lee, Director
Bureau of Sanitary Engrg.
State Board of Health
Jacksonville 1, Florida

### Georgia
W. H. Wier, Director
Water Pollution Control
Department of Public Health
Atlanta, Georgia

### Hawaii
B. J. McMorrow, Director
Bureau of Sanitation
Terri. Board of Health
Honolulu, Hawaii

### Idaho
H. C. Clare, Director
Div. of Public Health Engrg.
State Dept. of Pub. Health
Boise, Idaho

### Illinois
C. W. Klassen, Chief
Div. of Sanitary Engrg.
State Dept. of Pub. Health
Springfield, Illinois

### Indiana
B. A. Poole, Director
Bureau of Env. Sanitation
State Board of Health
Indianapolis, Indiana

### Iowa
P. J. Houser, Director
Div. of Pub. Health Engrg.
State Dept. of Health
Des Moines 19, Iowa

### Kansas
D. F. Metzler, Chief Engr.
Division of Sanitation
State Board of Health
Lawrence, Kansas

### Kentucky
F. C. Dugan, Director
Div. of Sanitary Engrg.
State Dept. of Health
Louisville 2, Kentucky

### Louisiana
F. J. Coogan, Tech. Advisor
Stream Control Commission
Baton Rouge 3, Louisiana

### Maine
F. W. Campbell, Director
Div. of Sanitary Engrg.
State Dept. of Health
Augusta, Maine

### Maryland
Paul W. McKee, Director
Water Pollution Control Comm.
2114 No. Charles St.
Baltimore 18, Maryland

### Massachusetts
Clarence I. Sterling, Director
Div. of Sanitary Engrg.
State Dept. of Public Health
Boston 33, Massachusetts

### Michigan
Milton P. Adams, Exec. Secy.-Engr.
Water Resources Commission
Lansing 1, Michigan

### Minnesota
F. L. Woodward, Chief
Env. Sanitation Section
State Dept. of Health
Minneapolis 14, Minnesota

### Mississippi
H. W. Kroeze, Director
Sanitary Engineering Div.
State Board of Health
Jackson 13, Mississippi

### Missouri
L. E. Ordelheide, Director
Bur. of Public Health Engrg.
Div. of Health of Missouri
Jefferson City, Missouri

### Montana
C. W. Brinck, Director
Div. of Sanitary Engrg.
State Board of Health
Helena, Montana

### Nebraska
T. A. Filipi, Director
Div. of Sanitation
State Dept. of Health
Lincoln 9, Nebraska

### Nevada
W. W. White, Director
Div. of Public Health Engrg.
State Dept. of Health
Reno, Nevada

### New Hampshire
W. A. Healy, Director
Div. of Sanitary Engrg.
State Board of Health
Concord, New Hampshire

### New Jersey
A. H. Fletcher, Director
Bur. of Env. Sanitation
State Dept. of Health
Trenton 7, New Jersey

### New Mexico
C. G. Caldwell, Director
Div. of Sanitary Engineering
State Dept. of Pub. Health
Santa Fe, New Mexico

### New York
A. F. Dappert, Exec. Secy.,
Water Pollution Control Ject.
State Dept. of Health
Albany 1, New York

### North Carolina
J. M. Jarrett, Director
Div. of Sanitary Engrg.
State Board of Health
Raleigh, North Carolina

### North Dakota
J. H. Svore, Chief Engineer
Env. Sanitation Service
State Dept. of Health
Bismarck, North Dakota

### Ohio
F. H. Waring, Chief Engineer
Div. of Sanitary Engrg.
State Dept. of Health
Columbus 15, Ohio

### Oklahoma
H. J. Darcey, Director
Div. of Sanitary Engrg.
State Dept. of Health
Oklahoma City 5, Okla.

### Oregon
C. M. Everts, Jr., Dir.
Div. of Env. Sanitation
State Board of Health
Portland 5, Oregon

### Pennsylvania
J. R. Hoffert, Chief Engr.,
State Sanitary Water Board
State Dept. of Health
Harrisburg, Penna.

### Rhode Island
W. J. Shea, Chief
Div. of Sanitary Engrg.
State Dept. of Health
Providence 2, R. I.

### South Carolina
W. T. Linton, Executive Director
Water Pollution Control Authority
State Board of Health
Columbia, S. C.

### South Dakota
C. E. Carl, Director
Div. of Sanitary Engrg.
State Dept. of Health
Pierre, South Dakota

### Tennessee
R. P. Farrell, Director
Div. of Sanitary Engrg.
State Dept. of Pub. Health
Nashville 3, Tennessee

### Texas
V. M. Ehlers, Director
Bur. of Sanitary Engrg.
State Dept. of Health
Austin, Texas

### Utah
L. M. Thatcher, Director
Div. of Sanitary Engrg.
State Dept. of Health
Salt Lake City 1, Utah

### Vermont
Philip Shutler, Commissioner
State Water Conservation Board
Montpelier, Vermont

### Virginia
A. H. Paessler, Exec. Secy.-Engr.
State Water Control Board
Richmond 20, Virginia

### Washington
E. F. Eldridge, Director
Pollution Control Commission
Olympia, Washington

### West Virginia
R. F. Rocheleau, Executive Secy.
State Water Commission
212 California Ave.
Charleston 1, W. Va.

### Wisconsin
Theodore F. Wisniewski, Director
Committee on Water Pollution
State Office Bldg.
Madison 2, Wisconsin

### Wyoming
L. O. Williams, Director
Div. of Env. Sanitation
State Dept. of Pub. Health
Cheyenne, Wyoming

## Interstate

### Potomac River
Edwin R. Cotton, Director
Interstate Commission on Potomac
River Basin
522 Transportation Bldg.
Washington 6, D.C.

### N.Y.-N.J.-Conn.
Seth G. Hess, Dir. & Chief Engr.
Interstate Sanitation Commission
110 William St.
New York 7, New York

### New England
Joseph C. Knox, Secretary
New England Interstate Water
Pollution Control Commission
73 Tremont St.
Boston 8, Massachusetts

### Ohio River
Edwin J. Cleary,
Exec. Dir. & Ch. Engr.
Ohio River Valley
Water Sanitation Commission
414 Walnut St.
Cincinnati, Ohio

### Delaware River
James H. Allen, Exec. Secretary
Interstate Commission on
Delaware River Basin
Broad Street Sta. Bldg.
Philadelphia 3, Pennsylvania

### Atlantic States
Wayne H. Heydecker, Secy.-Treas.
Atlantic States Marine
Fisheries Commission
22 West First St.
Mt. Vernon, New York

### Gulf States
W. Dudley Gunn, Secy.-Treas.
Gulf States Marine
Fisheries Commission
312 Audubon Bldg.
New Orleans 16, Louisiana

### Pacific States
Robert L. Jones, Chairman
Pac. Marine Fisheries Commission
340 State Office Bldg.
1400 S. W. Fifth Ave.
Portland 1, Oregon

### Bi-State Agency
Milton M. Kinsey, Chief Eng.
Bi-State Development Agency
915 Olive St.
St. Louis 1, Missouri

### Tri-State Comm.
H. L. Walster, Chairman
Tri-State Water Commission
N. D. Agricultural College
Fargo, North Dakota

# Meetings Scheduled

Apr. 2-4—Spartanburg, S.C. *(Clemson College)*
SOUTH CAROLINA WATER & SEWAGE WORKS ASSOCIATION. Sec'y, W. T. Linton, Wade Hampton Bldg., Columbia, S.C.

Apr. 6-8—Buffalo, N.Y. *(Hotel Statler)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

Apr. 15—Livermore Falls, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 16-17—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, Dept. Civil Eng., Univ. of Nebraska, Lincoln, Neb.

Apr. 16-17—Elmira, N.Y. *(Mark Twain Hotel)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, N. Y. 20, N.Y.

Apr. 16-18—Chandler, Ariz. *(Hotel San Marcos)*
ARIZONA SECTION A.W.W.A. Sec'y, M. V. Ellis, 46 W. Encanto Blvd., Phoenix, Ariz.

Apr. 16-18—Chandler, Ariz. *(San Marco Hotel)*
ARIZONA SEWAGE & WATER WORKS ASSOCIATION. Sec'y, M. V. Ellis, Sewage Treatment Plant, Phoenix, Ariz.

Apr. 16-18—Portland, Ore. *(Multnomah Hotel)*
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, O. P. Newman, Boise Water Corp., Boise, Idaho.

Apr. 16-17—Pullman, Wash. *(State College of Washington Campus)*
PACIFIC NORTHWEST INDUSTRIAL WASTES CONFERENCE. Director, E. B. Parker, State College of Washington, Pullman, Wash.

Apr. 22-24—Wichita, Kans. *(Hotel Broadview)*
KANSAS SECTION A.W.W.A. Sec'y, Harry W. Badley, 119 W. Cloud, Salina, Kans.

Apr. 22-24—Wichita, Kans. *(Hotel Broadview)*
KANSAS SEWAGE & IND. WASTES ASSOCIATION. Sec'y, D. F. Metzler, Marvin Hall, Univ. of Kansas, Lawrence, Kans.

Apr. 22-25—Santa Barbara, Calif. *(Mar Monte Hotel)*
CALIFORNIA SEWAGE & IND. WASTES ASSOCIATION. Sec'y, Sam A. Weed, Room 315, City Hall, Oakland 18, Calif.

Apr. 23—Kalispell, Mont. *(Kalispell Hotel)*
MONTANA SEWAGE WORKS ASSOCIATION. Sec'y, Harvey W. Taylor, State Board of Health, Helena, Mont.

Apr. 24-25—Kalispell, Mont. *(Kalispell Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

May 4-6—Lafayette, Ind. *(Purdue Memorial Union Bldg.)*
EIGHTH PURDUE INDUSTRIAL WASTE CONFERENCE. Chairman, Prof. Don E. Bloodgood, Purdue Univ., Lafayette, Ind.

May 10-15—Grand Rapids, Mich. *(Exhibits and Technical Sessions—Auditorium. Hotels—Various*)*
AMERICAN WATER WORKS ASSOCIATION (73rd Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
*(*For reservations apply A.W.W.A. Office)*

May 12—Grand Rapids, Mich. *(Hotel Pantlind)*
MICHIGAN SECTION A.W.W.A. (Business Meeting to be held during A.W.W.A. Convention). Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

May 20-21—Ocean City, Md. *(Commander Hotel)*
MARYLAND-DELAWARE WATER & SEWERAGE ASSOCIATION. Sec'y, W. M. Bingley, 2411 N. Charles Street, Baltimore, Md.

May 21-22—Richmond, Va. *(Hotel Jefferson)*
VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, J. L. Hamrich, Jr., 415 W. Franklin St., Richmond, Va.

June 3-5—Peoria, Ill. *(Hotel Pere Marquette)*
CENTRAL STATES SEWAGE & IND. WASTES ASSN. Sec'y, A. P. Troemper, Ill. Water Board, Springfield, Ill.

(*Continued on page* 100A)

NEW DEVELOPMENT INCREASES
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EFFICIENCY

Increase the oxygen content in:
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- waste liquids with depleted oxygen

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# 6 Essential Facts

*for a city with a Water Problem*
*. . . and a Budget Problem, too!*

**1. Costs Far Less to Install!**
A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

**2. Less Expensive to Operate!**
A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

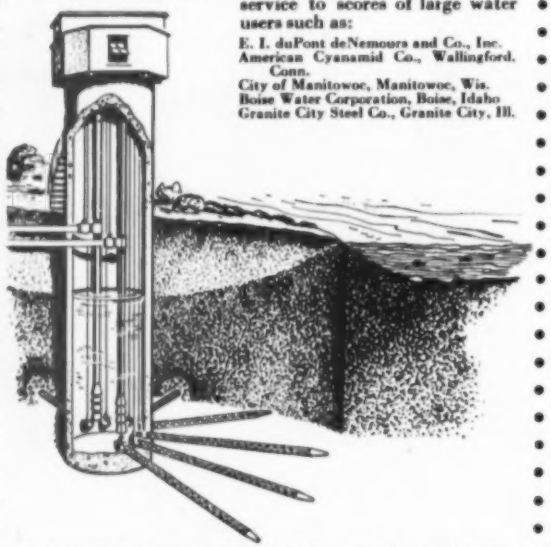
**3. Maintenance Requirements Practically Nil!**
A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

**4. More Water per Unit!**
A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

**5. Far Longer Life Cuts Depreciation Costs!**
The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

**6. Ask These Satisfied Users**
Ranney Water Collectors are currently rendering excellent service to scores of large water users such as:

E. I. duPont deNemours and Co., Inc.
American Cyanamid Co., Wallingford, Conn.
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



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If you need water, write us for complete information on how a Ranney Water Collector will solve your problem.

**Ranney Method Water Supplies, Inc.**

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Executive and Engineering Offices
Dept. C-4, P.O. Box 277, Columbus 9, Ohio


## Meetings Scheduled

(*Continued from page 99A*)

June 4-5—Laconia, N.H. *(Laconia Tavern)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. (Spring Meeting). Sec'y, Stephen M. Hurley, Jr., 331 State Office Building, Providence, R.I.

June 10—Bath, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

June 10—Martinsville, N.J. *(Martinsville Inn)*
NEW JERSEY SECTION A.W.W.A. (Summer Outing & Inspection of Johns-Manville Research Center, Finderne, N.J.—Luncheon at Inn). Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

June 17-19—Hershey, Pa. *(Hotel Hershey)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, Dept. of Health, Greensburg, Pa.

June 17-19—Akron, O. *(Mayflower Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, Ward E. Conrad, 301 Ohio Dept. Bldg., Columbus, O.

June 18—York Harbor, Me. *(Marshall House)*
NEW ENGLAND WATER WORKS ASSOCIATION (June Conference). Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

June 29-July 3—Atlantic City, N.J. *(Hotels Chalfonte and Haddon Hall)*
AMERICAN SOCIETY FOR TESTING MATERIALS. Sec'y, R. E. Hess, 1916 Race St., Philadelphia, Pa.

Aug. 12—Sanford, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 24-26—State College, Pa.
PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. R. Kountz, Penna. State College, State College, Pa.

Aug. 26-28—State College, Pa.
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 1-5—Winnipeg, Can. *(Royal Alexandria)*
MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Department. St. Paul 2, Minn.

Sept. 2-4—Ames, Ia. *(Iowa State College)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, P.O. Box 310, Webster, Ia.

Sept. 3-4—Morgantown, W. Va. *(Hotel Morgan)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, H. K. Gidley, State Dept. of Health, Charleston 5, W. Va.

Sept. 10-11—Lake Placid, N.Y. *(Lake Placid Club)*
NEW YORK SECTION A.W.W.A. Sec'y, R. K. Blanchard, 50 West 50 St., New York, N.Y.

Sept. 10-11—Cleveland, O. *(Hotel Cleveland)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

Sept. 21-23—Owensboro, Ky. *(Owensboro Hotel)*
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, R. Paul Farrell, 420 Sixth Ave. N., Nashville 3, Tenn.

Sept. 21-23—Owensboro, Ky. *(Hotel Owensboro)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. W. Finney, 420 6th Ave. N., Nashville, Tenn.

Sept. 21—Sante Fe, N.M. *(Hotel La Fonda)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 271 City & County Bldg., Denver, Colo.

Sept. 22-23—Sante Fe, N.M. *(Hotel La Fonda)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, George J. Turre, Board of Water Commissioners, P.O. Box 600, Denver, Colo.

Sept. 22-24—Milwaukee, Wis. *(Hotel Pfister)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wis.

Sept. 23-25—Edmonton, Alberta *(Macdonald Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. (Operators' School Sept. 23). Sec'y, W. J. Waddell, 617-7th Ave. East, Calgary, Alberta.

Sept. 27-29—Excelsior Springs, Mo. *(Elms Hotel)*
MISSOURI SECTION A.W.W.A. Sec'y, Warren A. Kramer, State Office Building, Jefferson City, Mo.

Sept. 28-30—Poland Spring, Me. *(Poland Spr. House)*
NEW ENGLAND WATER WORKS ASSOCIATION (72nd Annual Convention). Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

Oct. 4-6—Jackson, Miss. *(Hotel Heidelberg)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Chas. W. White, State Dept. Health, 537 Dexter Ave., Montgomery, Ala.

Oct. 11-13—Miami, Fla. *(Hotel to be announced).*
FLORIDA SECTION A.W.W.A. Sec'y, William W. Aultman, Dept. of Water & Power, Box 316, Coconut Grove Sta., Miami 33, Fla.

Oct. 13-16—Miami, Fla. *(Municipal Auditorium)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN. (26th Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
(joint Meeting with)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, D. P. Schiesswohl, P.O. Box 210, Jacksonville, Fla.

Oct. 14—Rumsford, Me.
MAINE WATER UTILITIES ASSOCIATION (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Oct. 14-16—Waterloo, Iowa *(Hotel Russell Lamson)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 18-21—Houston, Tex. *(Rice Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Auditorium, Little Rock, Ark.

Oct. 18-21—New Orleans, La.
AMERICAN PUBLIC WORKS ASSOCIATION. Exec.-Sec'y, D. F. Herrick, 1313 East 60th St., Chicago 37, Ill.

Oct. 19-24—New York, N.Y.
AMERICAN SOCIETY OF CIVIL ENGINEERS (Annual Meeting). Sec'y, Wm. N. Carey, 33 W. 29 Street, New York 18, N.Y.

Oct. 20-23—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 22-24—Atlantic City, N.J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 27-30—San Francisco, Calif. *(Palace Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, J. C. Luthin, 1113 Laurent St., Santa Cruz, Calif.

Oct. 28-30—Wilmington, Del. *(Hotel DuPont)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, C. J. Lauter, 6955 33rd Street, Washington 15, D.C.

Nov. 4-6—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, 708 State Office Bldg., Richmond 19, Va.

Nov. 9-11—High Point, N.C. *(Sheraton Hotel)*
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 12-13—Lincoln, Neb. *(Hotel Capitol)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Paul W. Mousel, 602 W. B. Street, McCook, Neb.

Nov. 8-13—New York, N.Y. *(Statler & New Yorker Hotels)*
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Nov. 16-20—Stillwater, Okla. *(Okla. A. & M. College)*
OKLAHOMA WATER, SEWAGE & IND. WASTES SHORT COURSE. Sec'y, H. J. Darcey, State Dept. of Health, Oklahoma City, Okla.

Dec. 9—Waterville, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Dec. 13-16—St. Louis, Mo.
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, F. G. Van Antwerpen, 120 East 41st St., New York 17, N.Y.

Dependable because they are tough and rugged. Made to withstand the wear and tear of the modern day strain and stress. For generations of incomparable service, only cast iron pipe can qualify. Serving the industry with Super de Lavaud Cast Iron Pipe, centrifugally cast, in modern long lengths.

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Modern in design and operating principle, the Hellige Turbidimeter does not require standard suspensions or long cumbersome tubes. Accurate readings can be made rapidly by those without technical training.

Precise determinations are performed in the ranges of zero to 150 p.p.m. $SiO_2$ and zero to 100 p.p.m. $SO_4$. Higher values are determined by diluting the specimen.

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877 STEWART AVENUE, GARDEN CITY, N. Y.

**STEVENS**

**TYPE B-FT RECORDER PROVIDES PERMANENT DATA ON SEWAGE FLOW**

At this modern sewage treatment plant in Dallas, Oregon, the STEVENS Type B-FT Recorder provides a permanent graphic record of flow in million gallons per day (range 0-6 MGD) and totalizes the volume in gallons. The STEVENS Recorder is mounted over a stilling well connected to a 9" throat width Parshall flume.

**record flow accurately . . . automatically**

There is good reason why modern municipal sewage and industrial waste measuring installations use the STEVENS Type B Recorder. It may be wall, pedestal or panel mounted, is easily operated and will give a lifetime of accurate, trouble-free service. This Recorder uses a circular chart which makes one revolution per day or per seven days, as specified, while the pen swings in an arc around an external center—the combined movements thereby producing a graph of the rate of flow (or head) against time. Volume is indicated on a counter-type totalizer. Accuracy of the registration is limited only by the accuracy of the rating to which the totalizer is set. Flow or head (or both) may be indicated on a scale clearly visible through a large glass port.

**RECORDS FLOW**
**RECORDS HEAD**
**TOTALIZES FLOW**
**Direct Float Operated or Remotely Controlled**

To find out more about the STEVENS Type B Recorder, and how it can simplify the task of compiling accurate flow records, write for FREE Bulletin 25.

**SEND FOR NEW STEVENS DATA BOOK**

Puts interpretive data at your finger tips. 144 pages of technical data . . . information on float wells and recorder installations . . . a wealth of hydraulic tables and conversion tables.

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## Research Assistantships Open in Sanitary Engineering

The State College of Washington has available half-time research assistantships in sanitary engineering starting in September, 1953. Students will be expected to pursue work for the degree of Master of Science in Sanitary Engineering. The rate of pay for the first year is $1400, for the second year, $1490. Full-time work is expected to be available during the summer.

Interested persons should write Prof. Emmett B. Moore, Chairman, Department of Civil Engineering, The State College of Washington, Pullman, Wash.

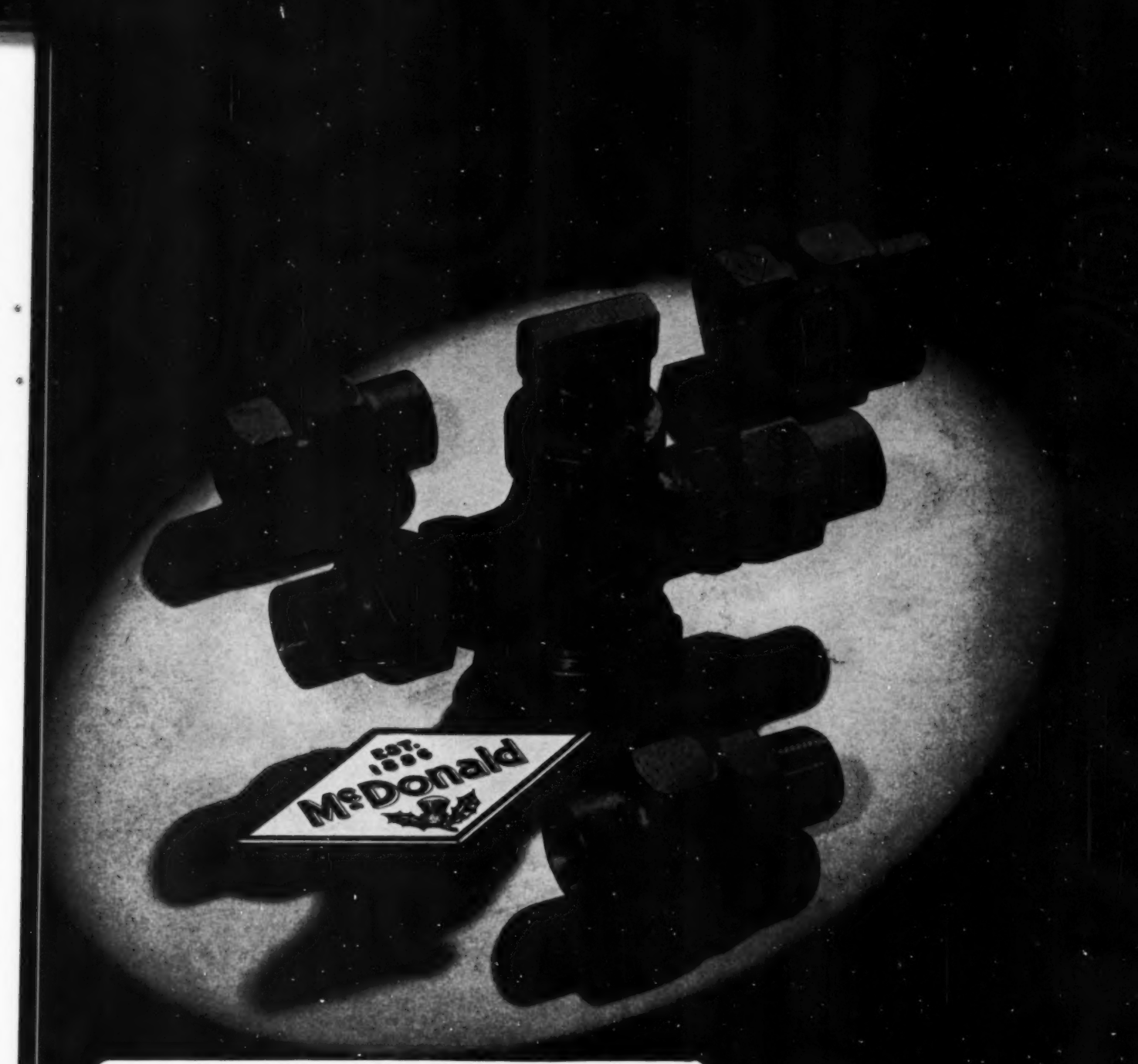
## London's Water Supply In Elizabethan Times

Among festivities for next spring will be the celebration of half a century of the Metropolitan Water Board's life. Great undertakings in the way of bringing water to cities have been numerous in recent times, but it was Queen Elizabeth who may be said to have set the fashion by granting the citizens of London leave to convey a stream to the Metropolis from any part of Middlesex or Hertfordshire.

In 1609 Hugh Myddleton, who had grown rich in Cardiganshire by gold-mining, persuaded the town council to transfer to him powers granted under acts of Elizabeth and James I. Myddleton encountered many difficulties and was nearly ruined before he had completed his plan, but on September 29, 1613, the water was let into the New River Head at Clerkenwell.

Stow tells us how "a troop of labourers to the number of sixty or more well apparelled . . . carrying spades, shovels, pickaxes, and such like instruments, celebrated the day by marching after drummes twice or thrice about the cisterne . . . and one man on behalf of all the rest, delivered a harangue in praise of the scheme and the persistence of Myddleton in face of many difficulties."

That was the beginning of what developed into an enormous concern in order to keep pace with London's continual growth.




## CRAFTSMANSHIP IN WATERWORKS BRASS

. . . results in uniform top quality. McDONALD Waterworks Brass is precision made from 85-5-5-5 metals with every step from foundry to final inspection and testing under rigid control. Shown above is E-4713-Stop, E-4753, E-4754 and E-4756- Copper Service Pipe Couplings.

An illustrated brochure with detailed specifications showing our complete line of Waterworks Brass will be sent to you promptly on request. A. Y. McDONALD MFG. CO., Dubuque, Iowa.

BRASS GOODS • PUMPS • OIL EQUIPMENT

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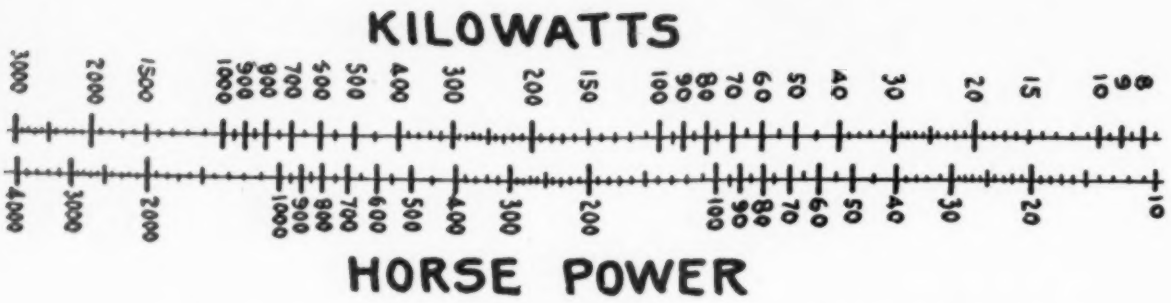
1856
McDonald




## Kilowatts to H.P. and Vice Versa*

The question often comes up as to the relationship between horse power and kilowatts. The exact figure is: one kilowatt is equal to 1.3411 horse power.

That is the figure to use for exact computing. But most of us don't like longhand figuring, and most of the time an absolutely accurate figure is not essential. So this writer prepared the accompanying simple scale. Just glance across from one scale to the other—and there's the answer. You read the scales in the same way that you read an ordinary thermometer.

For example, how many kilowatts in 100 h.p.? Find the 100 in the h.p. column and glance over to the kw column and there is the answer—75 kilowatts. For 10 h.p. you can use the same figure if you wish by knocking off one cipher and the answer will be 7.5 kw. Or, in the same way 1 h.p. equals 0.75 kw.

Now do this one: How many h.p. in 1500 kw? The answer, as the scale shows, is 2,000 h.p.

[Ed. Note: Sorry we had to turn the nomograph on its side, due to the proportions which made it a misfit if reproduced vertically.]

*Contributed by W. F. Schaphorst, M.E., Newark, N.J.

1—LOSS OF FIRE PROTECTION.

2—EXCAVATION AND PAVEMENT REPLACEMENT.

3—COSTLY REPAIRS INVOLVING MAJOR HYDRANT COMPONENTS.

4—FLOODING.

The Smith Protectop Hydrant is designed to permit rapid return to service at minimum cost when a Hydrant is damaged as a result of a traffic accident.

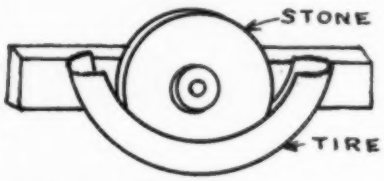
The Protectop Hydrant Standpipe and Valve Stem are equipped with Special Couplings located just above the ground. The Couplings withstand operating pressures and ordinary impact with an ample factor of safety. Under excessive impact occasioned by traffic accidents the Couplings fracture at the design points thus minimizing the damage and permitting speedy return to service at low cost.

All Smith Hydrants are equipped with Compression Type Valves which definitely eliminate flooding since the line pressure holds the Valve against its seat in the closed position.

Write for details.

38

THE A.P. SMITH MFG. CO.
EAST ORANGE, NEW JERSEY


## Old Auto Tire Makes Good Grindstone Water Trough*

Herewith a rough sketch showing how a friend of mine puts an old auto tire to good use as a water-trough for a grindstone. One half of almost any old tire will hold water.

My friend nailed the best half of an old tire to the wooden cross-beam on the grinder in such a way that the lower portion of the grindstone is continually immersed in water, in regular grindstone fashion. The stone is driven by means of a small four-cycle gasoline motor of the type used on lawn mowers.

*Contributed by W. F. Schaphorst, M.E.

Herb Shriner claims that in his home town the wealthiest citizen made his fortune by inventing a dog food that tasted just like the calf of a meter-reader's leg.

## High-Pressure Plastic Pipe

401

Kraloy Plastic Pipe Co., Inc., Los Angeles, Calif., has developed Kraloy "D-500," a new rigid vinyl plastic pipe which can handle corrosive chemicals at 500 PSI working pressure (77°F temperature). The pipe is now available in ½" to 4" sizes with all necessary molded fittings.

The new "D-500" plastic pipe, made from an exclusive Kraloy formulation, has many advantages over other types of plastic pipe as well as metal pipe. It is highly corrosion resistant and can be satisfactorily used for the transmission of practically all chemicals, including oxidizing agents, at temperatures up to 190°F. According to the company, it has a tensile strength of 10,000 PSI and the highest burst pressure and impact strength of any plastic pipe now being made. It is highly heat resistant and will not support combustion. Kraloy "D-500" can be used above ground, exposed to sunlight and weather. Ultraviolet rays have no effect. The pipe will not become brittle. It is also non-toxic.

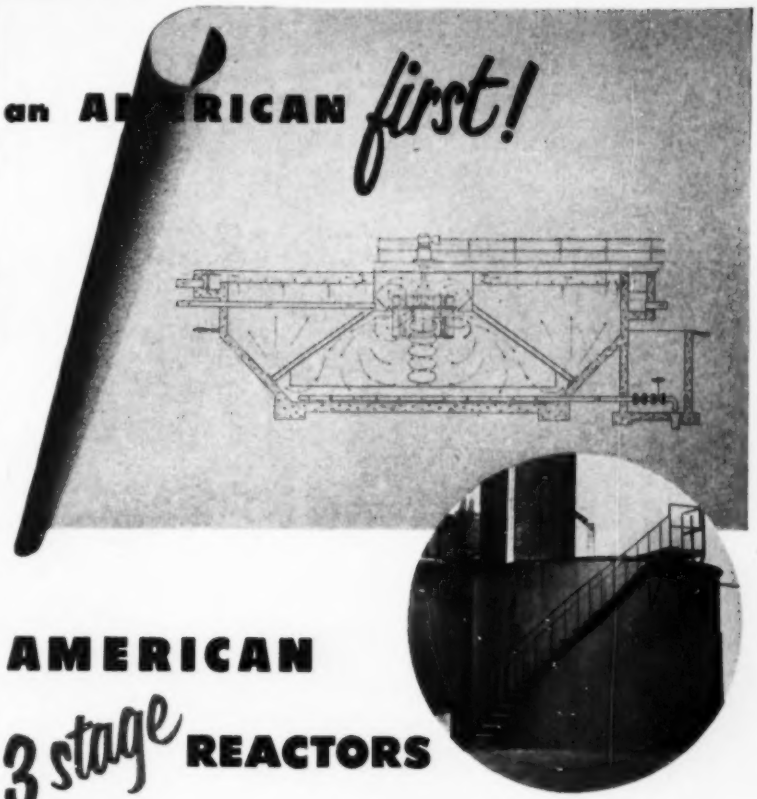
Carl C. Moore

W. S. Andrews

## Sales Appointments at Rockwell

Rockwell Manufacturing Company, Pittsburgh, Pa., has announced the appointment of Carl C. Moore as Central Regional Manager of Sales and W. S. Andrews as District Manager of the Pittsburgh district.

Mr. Moore obtained his B.S. degree in civil engineering from Wash-

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3 stage REACTORS
are more effective
softeners and clarifiers

For softening or clarification of surface water for industrial and municipal applications, American Reactors are unequalled in removing hardness, suspended solids, turbidity, color, taste and odor.

The American Reactor is a unique three-stage design in which the influent and reagents are actively agitated with pre-formed precipitates in the first stage. Agitation in the second stage is reduced and carefully controlled for ultimate coagulation and agglomeration, and in the third stage, stilling baffles further reduce agitation, providing ideal conditions for hydraulic separation of the floc and sludge.

By maintaining careful control of the hydraulic conditions affecting flow distribution, more effective removal of the contaminants is assured. This results in an effluent free from suspended matter, regardless of surge load conditions which upset other designs.

First in efficiency, American Water Conditioning Equipment is a result of over half a century of experience in the water conditioning field. Call or write today if you have a water problem.

SERVICE SINCE 1902 AMERICAN SYSTEM W A S C PATENTED TO THE INDUSTRY

AMERICAN Water Softener COMPANY
INCORPORATED
FOURTH AND LEHIGH AVENUE • PHILADELPHIA 33, PENNSYLVANIA
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HYDROGEN SODIUM ZEOLITE SOFTENERS • DEMINERALIZERS • CHEMICAL FEEDERS • CONTINUOUS BLOWDOWN • SWIMMING POOL EQUIPMENT

ington & Lee University and immediately joined the Lynchburg Foundry where he became general superintendent. After being discharged from the U. S. Army with the rank of Captain in World War I he became a salesman for Mesta Machine Company. He joined Rockwell in 1930 as head of the now defunct Meter Parts Company. Later he became district manager of the company's Atlanta office and more recently district manager of the company's Pittsburgh territory.

Mr. Andrews was district manager of the New York area before assuming his present position. He was formerly affiliated with Beaver Pipe Tools, Inc. of Warren, Ohio, and joined the Nordstrom Valve Division of Rockwell as a salesman in 1932.

Both men are members of the Engineers' Society of Pennsylvania, American Gas Association and the American Water Works Association.

## Plastic Pipe by Atlas

402

Atlas Mineral Products Company, Mertztown, Penna., announces, as a result of three years development work, that it now has available a complete line of plastic pipe based on high impact styrene in sizes ranging from ½" to 6" O.D. Threaded fittings are available in sizes up to 2".

This product is known as AMPCOLITE and supplements the Ampcoflex rigid polyvinyl line pioneered by this firm. Ampcolite pipe, which is available in 10' and 20' lengths, has outstanding impact resistance and good resistance to a wide variety of corrosives.

WHEN YOU CAN "RECEIVE"!

Here is a photograph of a man turning a payment into an income . . . with the aid of a Royer Sewage Sludge Disintegrator. Instead of paying to have sludge cake hauled away, burned or buried, he is processing it into a valuable, easily salable commercial fertilizer. All he need do is shovel the cake direct from the drying beds into the low hopper and a perfectly shredded and pulverized ready-to-use fertilizer is discharged to pile or truck, free of all contamination.

Florists and nurserymen, golf courses, gardeners, parks and mushroom growers furnish a steady demand for this easy-to-apply, nitrogen rich fertilizer.

Many sewage disposal plants are turning an expense item into an income with a Royer. Available in gasoline engine, electric motor or belt-to-tractor drives and in capacities to suit any need. Investigate the possibilities in your plant. Write for detailed information.

A Royer Model NSH at the Sewage Disposal Plant, City of Sarasota, Florida

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

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E. P. Roudebush
V.P. Works Mgr.

## Roots-Connersville Appoints Two Vice-Presidents

Roots-Connersville Blower Division of Dresser Industries, Inc., has announced the promotion of Mr. E. P. Roudebush to Vice President and Works Manager, and Mr. D. A. Johann to Vice President in Charge of Sales.

Mr. Roudebush will be in charge of all manufacturing activities at the Connersville, Indiana, and Delaware, Ohio plants. He is a native of the State of Ohio and is a graduate of Ohio State University. In 1944, he joined the parent company, Dresser Industries, Inc., as Director of Industrial Engineering, coming to Roots-Connersville in January, 1950, as Assistant to Vice President in Charge of Manufacturing. Mr. Roudebush has been Works Manager since January, 1951.

Mr. Johann will be in charge of all sales and advertising activities of the company. He is a native of Pennsylvania, and a graduate of Pennsylvania State College, State College, Pennsylvania. Mr. Johann joined the Roots-Connersville organization in 1946 as Manager of the Chicago District Office. Since January, 1951, he has been General Sales Manager.

## Dr. Ulmer Joins Combustion-Engineering

Combustion Engineering—Superheater, Inc., New York, N.Y., has announced that Dr. R. C. Ulmer, well known in the power field as a feedwater specialist and for the last seven years technical director of E. F. Drew & Co., has joined the Engineering Department of the company where he

(Continued on page 108A)

# Freezing Losses Reduced by the SIMPLICITY of FROST BOTTOM AMERICAN METERS

● A freeze-up can mean costly shop repairs or a minor "on-the-spot" change. American Frost Bottom Meters have a simple patented construction that permits the bottom casing to break by tension and relieve the internal pressure in the event of a serious freeze-up.

All the more delicate—most costly parts—including the gear train—are protected. The breaking pressure is pre-tested at the factory. Hundreds of thousands of meters in service are proof of the effectiveness of this design.

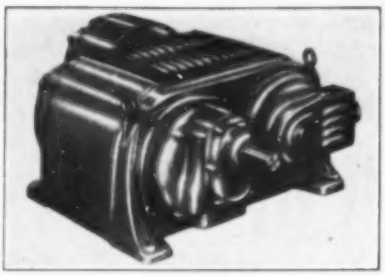
***Ask for complete data.***

## BUFFALO METER CO.

**2909 MAIN STREET, BUFFALO 14, NEW YORK**

will be engaged in development work.

A graduate of Ohio State University, from which he later acquired his doctorate, Dr. Ulmer spent some years as a chemist in the Research Department of The Detroit Edison Company where he was associated with many power plant operating problems. He has written many technical papers and articles and holds membership in The American Society of Mechanical Engineers, The American Chemical Society, The American Society for Testing Materials, The American Water Works Association, and The National Association of Power Engineers.



## New 30 H.P. Horizontal Varidrive

403

U.S. Electrical Motors, Inc., Los Angeles, Calif., has announced that Varidrive Motors are now available in horizontal assembly up to 30 HP through the addition of a new horizontal frame size—64 VE. This development by the company makes possible a more compact motor installation in applications demanding horizontal assemblies.

The 64 VE possesses all the plus features of the upright 64 Varidrive including all-in-one construction (motor, variable speed transmission and gearing when necessary), microspeed control and indicator, splined Varidisc sheaves, double cog Varibelts with Autotaut tension control for permanent belt adjustment, dual belt construction, asbestos-protected motor and normalized castings. This Varidrive is also available in combination with the U.S. Syncrogear with either single or double reduction gearing.

Motor controls may be conveniently located above or at the side of the motor. Remote controls are available either with mechanical extensions or electric push button stations. Varidrive motors are offered in ratings from ¼ to 50 HP with speed variations up to 10:1. Speeds from 2 to 10,000 rpm.

# His days are numbered!

**Yes, it's time to say goodbye to Mr. Wet Chlorine Gas. Chlorinating equipment which has to cope with this character is subject to: (1) rapid deterioration of metallic parts, (2) frequent repair and replacement of expensive equipment, (3) faulty operation of partially corroded parts, and (4) troubles from chlorine hydrate.**

**Hundreds of modern plants have eliminated wet chlorine problems by installing BUILDERS Visible Flow CHLORINIZER . . . the chlorine gas feeder which meters and controls chlorine gas in the DRY state. You can reduce your problems *and* your costs by putting *this* feeder to work in your plant . . . for simpler, lower maintenance and more economical chlorination every month of the year . . . and for years to come.**

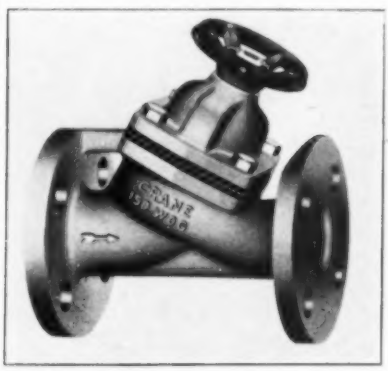
**For full details, write for descriptive Bulletins. Builders-Providence, Inc., 350 Harris Ave., Providence 1, R. I.**

BIF INDUSTRIES

**BUILDERS-PROVIDENCE**

(DIVISION OF B-I-F INDUSTRIES)

BUILDERS


## Packless Diaphragm Valves

404

Crane Co., Chicago, Ill., has announced the addition of several new body, diaphragm, and lining materials to its line of packless diaphragm valves.

These valves are now regularly available with cast iron, brass, aluminum, or 18-8 Mo bodies and disc holders; and with diaphragms and disc inserts of Neoprene, Buna-N, and soft natural hard rubber linings. Specially prepared valves for vacuum, oxygen, and acetylene service are also now regularly available.

Outstanding feature of the Crane diaphragm valves is the separate diaphragm and disc construction. Since the diaphragm is not used for seating, it is not subjected to the

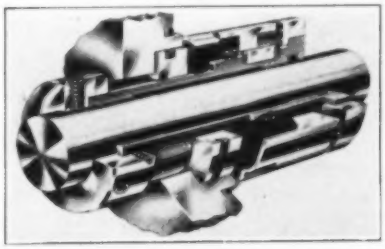
cutting, crushing, and abrasion that lead to rapid wear. Closure of the independent disc will prevent escape of line fluids even if the diaphragm should fail.

## Neptune Appoints J. C. Judge Portland Manager

The Neptune Meter Company, New York, N.Y., has announced the appointment of James C. Judge as Manager of their Portland, Oregon, branch.

Mr. Judge joined the company in September, 1945 and since that time has represented the company in Western Oregon and Western Washington, making his headquarters at the Portland office.

He succeeds Mr. E. W. Thompson who retired from active company service on January 1, 1953.



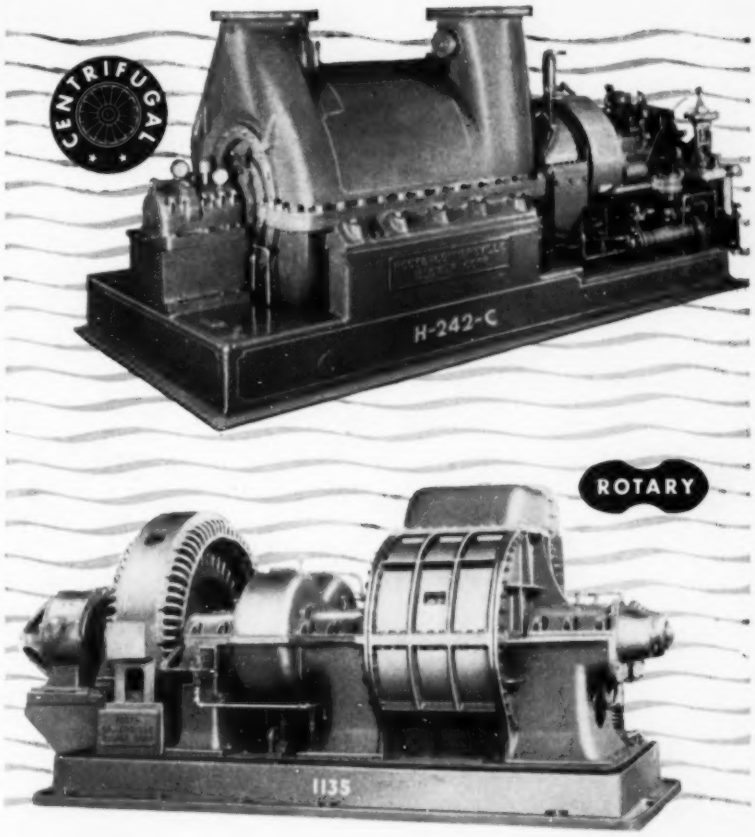
## Heavy-Duty Type Balanced Mechanical Seal

405

Crane Packing Company, Chicago, Ill., has developed a heavy-duty mechanical seal which will withstand pressures up to 1,000 psi. Known as the Type 8-B Shaft Seal, it is designed for applications where ruggedness to withstand high pressures is an important factor.

A packaged unit, the Type 8-B Shaft Seal is factory inspected and furnished preassembled on a sleeve for ready installation. When used with split case pumps it is not necessary to lift the upper half of the casing to install or remove the seal. Extremely compact design adapts it for use in conventional pump stuffing boxes.

Incorporating a rotating sealing washer and a "floating" stationary seat, balance is accomplished by




BLOWER RELIABILITY A "NATURAL" WITH AIR-MINDED *Specialists*

The long record of reliability established by Roots-Connersville Blowers, Exhausters and related equipment is the natural result of almost a century of experience in the exclusive business of handling gas and air for industrial purposes.

But its more than just designing and building *a* piece of machinery. Such user satisfaction comes also from the wide range of capacities and types, from which the right unit can usually be selected. Especially important, our *dual-ability line* of Centrifugals and Rotary Positives enables us to make unbiased recommendations . . . a *dual choice* available only from Roots-Connersville.

Whatever your need may be in the handling of air or gas for sewage or water treatment plants, you can look to Roots-Connersville for unquestioned reliability and long-time economical performance. Ask us for specific recommendations on any problem of handling gas or air—in any quantity.

ROOTS-CONNERSVILLE

*Exclusive Specialists in Handling Gas and Air*

BLOWER BUILDERS SINCE 1854

ROOTS-CONNERSVILLE BLOWER

A Division of Dresser Industries, Inc.
235 Mount Ave. • Connersville, Indiana

lowering the washer face to a point where stuffing box pressure is not exerted against the sealing area. To insure peak efficiency, mating faces of the washer and seat are precision-lapped to .0000232 in.

"O" Rings provide sealing between sleeve and shaft and also between washer and sleeve. This affords sufficient flexibility in the rotating assembly to compensate for axial and radial shaft movement and for normal wear of sealing faces. Another "O" Ring is used between the stationary seat and end plate as a cushioning to prevent stresses on the highly lapped seat face.

## Danielson Appointed Branch Manager by Bailey Meter

Bailey Meter Company, Cleveland, Ohio, has announced the appointment of A. L. Danielson as manager of their branch office in Denver, Colorado, located at 1506 Kearney Street. He succeeds G. M. Wallace, who has recently been appointed an Assistant Sales Manager with headquarters in Cleveland.

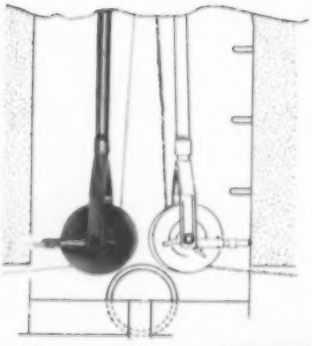
Mr. Danielson is a graduate mechanical engineer of the University of Illinois. He will supervise the sales and service work of automatic steam plant and process control equipment in Colorado, Wyoming, Utah, New Mexico, and the Texas panhandle.

Now!

BUCKET MACHINE SEWER CLEANING

Made Easy!

Set-Up Time CUT 80% by FLEXIBLE'S New Surface-Hung MANHOLE ROLLER



**No Climbing Down Manholes!**

Now, instead of merely hand-rodding a temporary opening in the stoppage (for so-called economy's sake)—FLEXIBLE has the answer. In a fraction of the time of installing ordinary jacks, this new smooth-operating MANHOLE ROLLER installs from the surface... fits any manhole (even over-flowing)...works loose brick manholes...and enables you to do a *thorough* BUCKET MACHINE job faster, easier, economically.

PAT. APPLIED FOR

WRITE today

Flexible

SEWER-ROD EQUIPMENT CO.

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801 E. Excelsior Blvd. — Hopkins, Minn.
3786 Durango St. — Los Angeles 34, Calif.
4455 S.E. 24th Street — Portland, Oregon
351 West Jefferson Blvd. — Dallas, Texas
Francis Hankin — Montreal & Toronto, Canada

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

## Truck-Mounted Shovel-Crane

406

Schield Bantam Company, Waverly, Iowa, has developed a new, heavy-duty truck-mounted shovel-crane, providing 20% more lifting capacity than previous Bantam models. Conservatively rated at 6 tons capacity, the new ⅜-yd. heavy-duty Model T-35 is already in full production, with a complete line of matching attachments, including shovel, clamshell, dragline, back hoe, magnet, wood grapple and pile driver.

Major improvements over previous Bantam Model M-49 machine include: a stronger main frame; larger shafts and bearings throughout; bigger diameter center pin; newly designed trunnion base with wider trunnion rollers and the use of 4 adjustable cam-type hook rollers instead of three. The T-35's vertical swing shaft bearing allows for almost twice as much radial load on the shaft, compared to the M-49 model.

The new Schield Bantam Model T-35 offers more efficient performance because of substantial increases in both clutch and braking surfaces. A power boom hoist which gives power lowering as well as raising is retained as standard equipment in the new heavy-duty Model T-35.

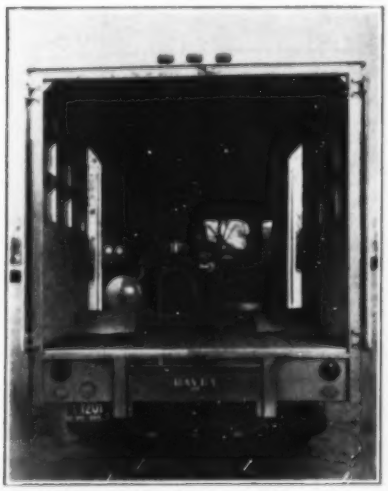
The new, heavy-duty Model T-35

Bantam can be mounted on any new or used tandem axle truck having a wheelbase of 164" or more. Suitable single axle trucks can also be used when ground conditions are favorable.

## Beckman Appoints Wilkinson Market Research Manager

Beckman Instruments, Inc., South Pasadena, Calif., has announced the appointment of James D. Wilkinson as Manager, Market Research Division.

Formerly Manager of Commercial Research at Soule Steel Corporation, San Francisco, and regional research manager for Kaiser Aluminum and Chemical Sales Corporation, Wilkinson brings a highly specialized background to his new position. He received the first degree ever given in Public Relations at the University of California in 1949. His academic training includes electronics at the University of Houston, Texas, Industrial Relations at University of California and engineering at Los Angeles City College.

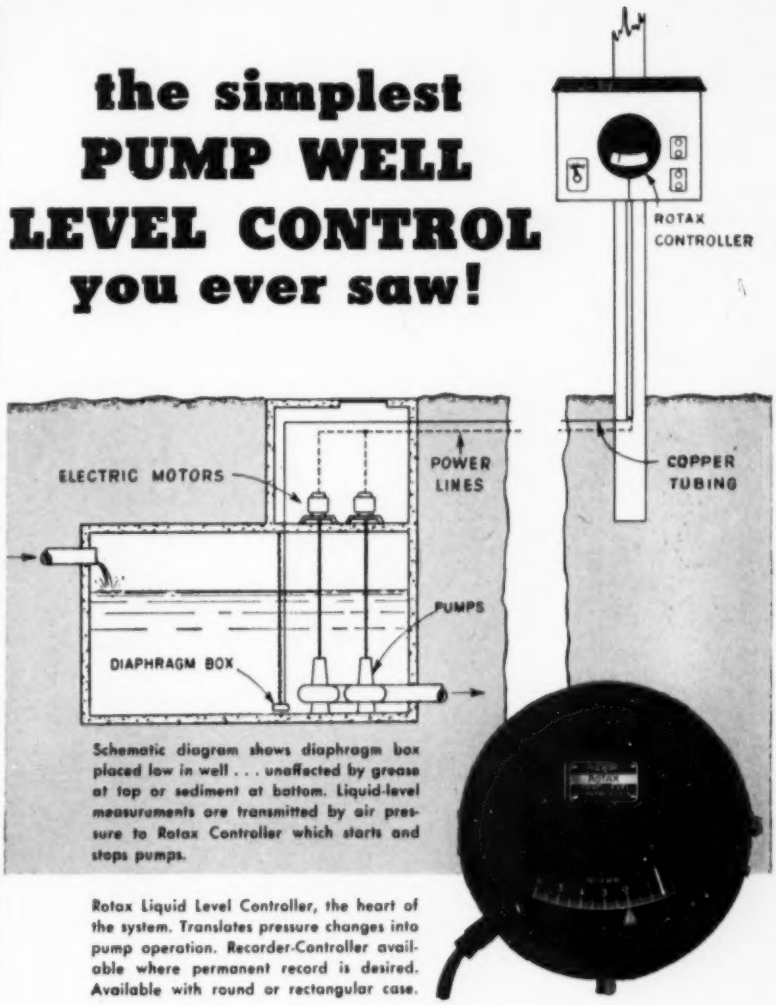


## Truck Mounted Air Compressor

407

Davey Compressor Co., Kent, Ohio, has announced a new truck-mounted air compressor assembly, known as the "Air Van."


# the simplest PUMP WELL LEVEL CONTROL you ever saw!




Schematic diagram shows diaphragm box placed low in well . . . unaffected by grease at top or sediment at bottom. Liquid-level measurements are transmitted by air pressure to Rotax Controller which starts and stops pumps.

Rotax Liquid Level Controller, the heart of the system. Translates pressure changes into pump operation. Recorder-Controller available where permanent record is desired. Available with round or rectangular case.

## Easier to install . . . accurate for years without attention

For a new underground sewage pumping station, the town of Norwood, Mass., wanted automatic control that would perform dependably without attention, free from usual corrosion and maintenance problems. Foxboro Pump Well Level Control proved an effective solution . . . with the added advantages of greatly simplified installation and operation.

Foxboro Pump Well Level Control employs a simple cast iron or bronze diaphragm pressure box for measurement . . . instead of a float-type measuring system. No cables, levers, floats or pulleys to corrode or clog. The Foxboro Controller may be located up to 500 ft. from the well, with only a copper or stainless steel tube connection. All adjustments easily made at the instrument. Controller contacts not subject to corrosive atmosphere.

Get full details of this improved automatic Level Control for either water or sewage pump wells. Write for Application Engineering Data Sheet 831-9. **The Foxboro Company, 8910 Neponset Ave., Foxboro, Mass.**

FOXBORO Reg. U. S. Pat. Off. PUMP WELL LEVEL CONTROL

Designed around the recently-introduced Fageol Van truck, manufactured by Twin Coach Company, Kent, Ohio, the unit is said to be the most compact and efficient compressor truck assembly ever developed. Because of its integral construction, the van provides approximately 200 more cubic ft. of payload space than any truck of similar length and wheelbase. Consequently, the compressor occupies only about one quarter of the truck body space, leaving the remainder available for the transportation of men, tools and materials.

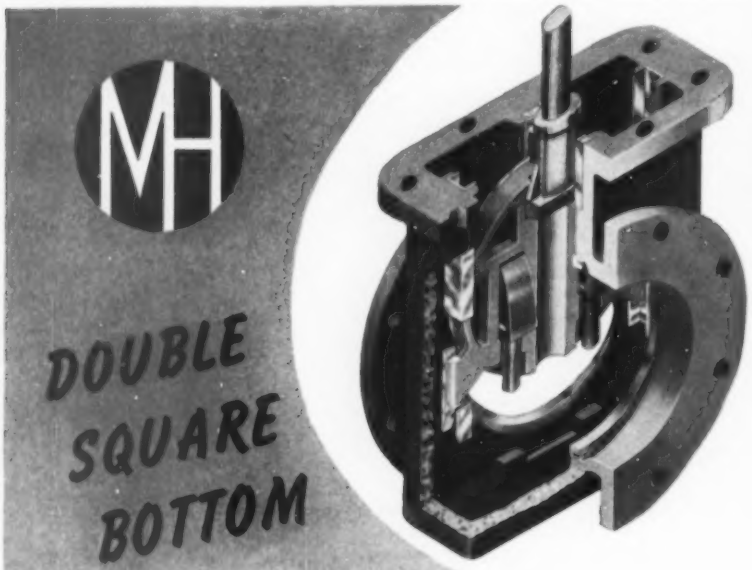
Air Vans are offered with a choice of either 105 c.f.m. or 160 c.f.m. standard Davey "Auto-Air" compressors. These are driven directly from the truck engine through a Davey Heavy Duty Power Take-off installed in the truck driveshaft.

Air Vans, according to the manufacturer, are especially suitable for use by public utilities or contractors operating over extensive areas.

## Kraloy Adds E. J. Hall

Kraloy Plastic Pipe Co., Inc., Los Angeles, announces the appointment of E. J. Hall as western sales representative to service gas and water utilities, and industrial firms.

The company manufactures a complete line of plastic pipe and fittings, including Kraloy O-125 for gas and water lines, Kraloy D-500 for handling corrosive chemicals under pressure, and flexible Kraloy Polyethylene pipe.

DOUBLE SQUARE BOTTOM

GATE VALVES

When it is desired to install a gate valve for throttling purposes, or in a vertical pipe line, M & H double square bottom valves have many important advantages.

When valve is opened, each of the three shoes on both discs immediately contact the feathered edge of the tracks. These three contacts result in the disc being eased away instantly from the seat. The shoes then ride the tracks squarely and firmly for the full travel of the disc. In closing, discs ride the tracks down to a point exactly opposite the valve seat. At that point, the discs are clear and free to seat by action of the two spreaders, each functioning independently of the other.

M & H double square bottom valve prevents the down stream gate from tilting into the down stream port opening and by chatter or vibration damaging the seat and gate rings. These valves can be installed with either disc on the down stream side.

Available in classes A, B, and C, sizes 3" and larger. Where needed, can be supplied with rollers; or roller, tracks and scrapers. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

## Small Ion Exchange Filter

408

Win Sales Company, Forest Hills, N.Y., has developed a small size ion exchange resin filter. The convenient hand unit consists of a flexible plastic bottle with a plug-in resin filter top. To operate it, simply fill the bottle and squeeze—the raw water flows through the filter and is instantly ready for use.

In addition to the hand unit, the company also makes larger unit with a built-in meter that indicates the exact purity of the water at any given instant.

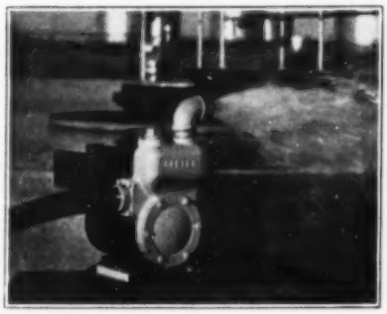
## Caltech Appoints Dr. Beckman Trustee

Dr. Arnold O. Beckman, president and founder of Beckman Instruments, Inc., was one of two men appointed February 2nd to the Board of Trustees of the California Institute of Technology at Pasadena.

The 24-member policy governing body includes such prominent figures as Dr. Robert A. Millikan, Nobel prize winner; Norman Chandler, president of the Los Angeles Times-Mirror Company; Herbert Hoover, Jr., son of the former U. S. President.

An Institute Associate since 1948, Dr. Beckman is the first alumnus

elected as trustee. He received his doctorate in chemistry from the Institute in 1928 and served on the faculty from 1929 to 1940, leaving to enter the field of precision instrument manufacturing.



## Advanced New Line of Humdinger Self-Priming Centrifugal Pumps

409

Ralph B. Carter Company, East Orange, N.J., has developed an entirely new and completely different line of Humdinger Self-Priming Centrifugal Pumps.

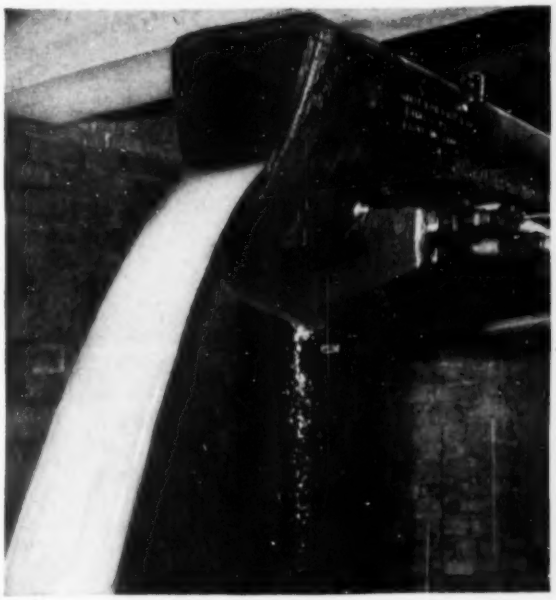
According to the company, the New Humdinger is the simplest self-priming centrifugal ever developed. The only components inside the volute case are the impeller and the seal. This new pump excludes every other possible wearing part contributing to the hydraulic and mechanical losses common to ordinary pumps of this type.

The development of Twin Coaxial Volute passages, by Carter Engineers, results in a highly efficient volute design that makes possible greater capacity, faster priming and more trash handling ability. This greater efficiency within the volute means a new standard of performance that gives higher Capacity-Head abilities, with normal engine sizes, than those specified by standard pump ratings. The new Humdinger 1½ inch pump is rated and guaranteed by the manufacturer at 5500 gallons per hour.

Lighter and more compact than any of its counterparts in the field, this rugged, hardworking pump is built for continuous service under the most difficult pumping conditions. Its large, unobstructed volute passages . . . abrasive resistant, open type impeller . . . absence of clogging parts . . . all add up to a remarkable solid, muck and sludge handling ability. Shaft seal and suction check valve are made of positive sealing, oil and gas resistant neoprene.

A new and unique principle of adjustment compensates for impeller

(*Continued on page* 116A)



*For Accurate Measurement of*

RAW WATER, TRADE WASTES, SEWAGE

*Specify* SIMPLEX TYPE S PARABOLIC FLUME

Intelligent planning of industrial waste or sewage treatment facilities requires accurate flow data. Accurate control of processes and dosages are wholly dependent on accurate flow measurements.

Quite often, conventional types of primary devices can't answer this basic question because of adverse conditions such as: low flows under low head conditions; very wide flow ranges; heavy sediment or suspended solids; size, layout or grade of existing approach section; corrosive liquors in channels or pipes.

Simplex Type S Parabolic Flume was designed specifically to master *all* of these problems . . . accurately measures free-flowing wastes or sewage over a FULL 20 to 1 flow range!

Compact Type S Parabolic Flume is simple to install . . . requires a minimum of supporting structure, as shown in the above installation. Carefully machined levelling pins assure the correct grade for accuracy. No special approach section is needed.

Available in standard pipe sizes of 6" to 36", with bell, spigot or flanged inlet, Type S Parabolic Flume can be attached to even larger pipe sizes by means of eccentric reducers.

INTERESTING FREE BULLETIN

Why not get full details today. Write for Bulletin 800. Simplex Valve & Meter Company, 6743 Upland Street, Philadelphia 42, Pa.

IT'S SIMPLEX IT'S ACCURATE

SIMPLEX®

VALVE AND METER COMPANY

# ADVANCED BADGER ENGINEERING

## brings you BADGER METER TESTERS

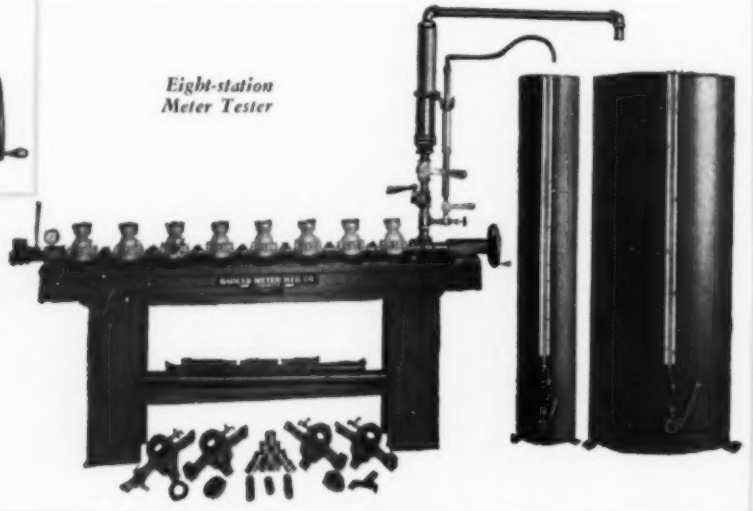
Make a place in your set-up for Badger Meter Testers. You need them . . . 1 — Because they faithfully record meter accuracies and help you to increase revenue . . . 2 — Because, with their Visible Rate-of-Flow Indicators, they accurately indicate rates of flow from 1/16-gallon to 160 gallons per minute . . . positively, not just proportionally . . . 3 — Because they act as insurance against water revenue losses.

BADGER METER TESTERS are the only completely equipped testers made. NO EXTRAS TO BUY. Four sizes available . . . to handle two, four, six or eight ⅝-inch meters of any make, as well as varying quantities of larger sizes up to and including 2-inch.

Depending on your requirements you may select any of four combinations of BADGER METER TESTERS . . . 1 — With BOTH large and small Visible Flow Indicators* and BOTH 10-gal. and 100-gal. calibrated tanks**; 2 — With large indicator only; 3 — With small indicator only; 4 — Without either indicator. (Note: *The LARGE Visible Flow Indicator accurately indicates flow from 5 to 160 gallons per minute; the SMALL Indicator, 1/16-gallon to 10 gallons per minute. These Visible Flow Indicators are *positive*, not merely *proportional*, in their indications. **The Calibrated Tanks are fully assembled with gauge glass, plumb bob, graduated scale and bronze drain valve. On each side of the gauge glass are mounted brass angle strips, enameled white, with graduation marks in high visibility black . . . in U. S. Gallons, Imperial Gallons, Cubic Feet, Litres, or any other units of measure desired. The tanks are heavy gauge steel with all joints welded).

Ruggedly built, BADGER METER TESTERS are long-lived and dependable. The Test Pan and legs are reinforced, welded, structural steel, light in weight and unbreakable. The Test Bench Pan, 5" deep, has its upper edge turned inward to prevent water from splashing over the edge while draining meters after testing. This in-turned edge also locks the supports in place when the tail stock is tightened . . . NO BUCKLING. The interchangeable meter supports are furnished with petcocks to release all air and set the meter test hands to zero before testing.

*Close-up view of tail stock, quill and flow-indicators.*



*Eight-station Meter Tester*

Spacer pipes are furnished for fill-in whenever it is necessary to test fewer than the total meter-capacity of the tester.

The tail stock quill, when moved, rides on supports on the test bench bed, so the load is carried on the quill supports rather than on the quill itself.

In every detail BADGER METER TESTERS are soundly engineered to serve you long and accurately. Write for further information and prices.

**BADGER METER MFG. CO., Milwaukee 45, Wis.**

Branch Offices: New York City • Philadelphia • Worcester, Mass. • Savannah, Ga. • Cincinnati • Chicago • Kansas City
Waco, Texas • Salt Lake City, Utah • Guthrie, Okla. • Seattle, Wash. • Los Angeles

BADGER *Water* METERS

"MEASURING THE WATER OF THE WORLD"

FOR ACCURACY • LOW-COST MAINTENANCE • DURABILITY • SENSITIVITY

# MOVING TOWARD NEW SOLUTIONS*

Working out new and varied solutions to old problems

is a fundamental part of Niagara's service to industry

## NIALK® Liquid Chlorine

**The first liquid chlorine to be produced in commercial quantities, NIALK Liquid Chlorine has helped protect public health through the purification of drinking water for more than fifty years.**

**Backed by constant research, produced with the strictest attention to quality control, this NIALK product—like every NIALK product—meets industry's most exacting specifications.**

## NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

* NIALK LIQUID CHLORINE · NIALK CAUSTIC POTASH

NIALK CARBONATE OF POTASH · NIALK PARADICHLOROBENZENE

NIALK CAUSTIC SODA · NIALK TRICHLOROethylene

NIAGATHAL® (TETRACHLORO PHTHALIC ANHYDRIDE)

wear without disassembling or replacing a single interior part. No shims, wear plates or replacement parts of any kind are required. This simple adjustment may be accomplished in a matter of minutes.

Made in a complete range of sizes —1½" (5500 GPH) to 10" (250,000 GPH)—the Humdinger is available with gasoline or diesel engines, electric or belt drives.

## McCutcheon Heads Sales of Homestead Valve

Homestead Valve Manufacturing Company, Coraopolis, Penn., has announced the appointment of James R. McCutcheon, Jr., as Sales Manager of the Valve Division.

After attending Perry High School, Staunton Military Academy, and the University of Virginia, Mr. McCutcheon received his early sales training with National Tube Company, and among industrial distributors of the Pittsburgh area. For the past seven years he has served as District Representative for American Car and Foundry Company's Valve Division in Western Pennsylvania, Ohio, Kentucky, and West Virginia.

Mr. McCutcheon will make his headquarters at Homestead Valve's main plant in Coraopolis, Pennsylvania.

P. C. Kreuch

C. C. Shenkle

## Rockwell Makes Two Executive Appointments

Rockwell Manufacturing Company, Pittsburgh, Pa., has announced the appointments of Paul C. Kreuch as Assistant to the Vice President in charge of Sales and Courtney C. Shenkle as Assistant to the Vice President in charge of Manufacturing.

Mr. Kreuch received his B.S. degree from the University of Nebraska in 1923 and was first affiliated with the Lincoln Gas and Electric Company as a Results Engineer in Omaha. He later became the Chief Engineer for the Missouri Public Service Company, and in 1927 joined Burns and McDonnell Engineering Co.

He came to Rockwell in 1930 and spent four years as a Sales Engineer in the San Francisco and Tulsa areas and was then promoted to District Manager of the Chicago area. For the past year he has been Regional Sales Manager of the Central Region which extends from Pittsburgh to the Midwest.

Formerly, Mr. Shenkle was Assistant to the President of the Pittsburgh-DuBois Co. When this company became a division of Rockwell in 1947 he was named Assistant to the General Manager and finally became General Manager.

In 1950 he was transferred to the Freeport, Illinois, division, and more recently he was assigned to the Macnick Division.

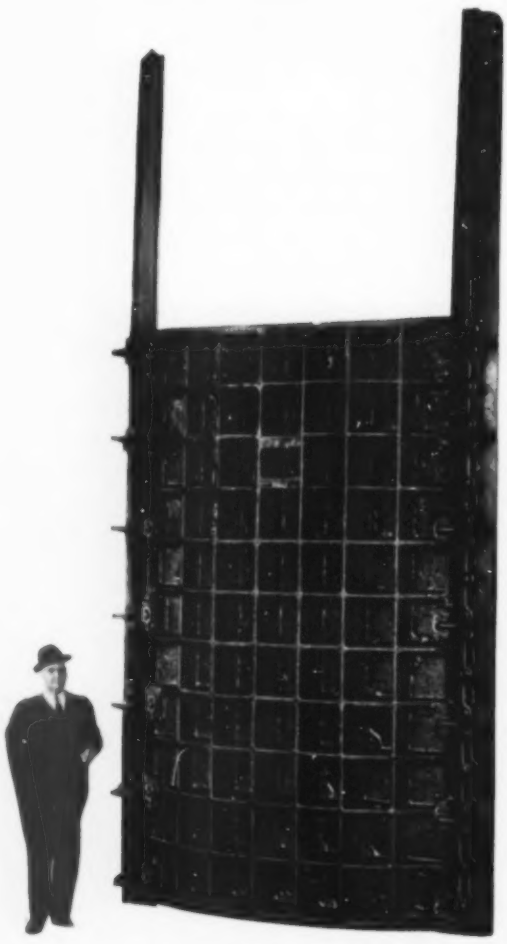
## Polyethylene Valves

410

American Agile Corporation, Bedford, Ohio, has developed 1 and 2 inch bore valves, made throughout of Polyethylene.

The valves, known as Agilene Valves, are extremely light in weight, (2 inch valve weighs less than 6 pounds) and resist hydrofluric, sulfuric, nitric, and hydrochloric acids at temperatures up to 160°F.

The valves are furnished with standard drilled flanges for easy in-

**FILER & STOWELL SLUICE GATES**

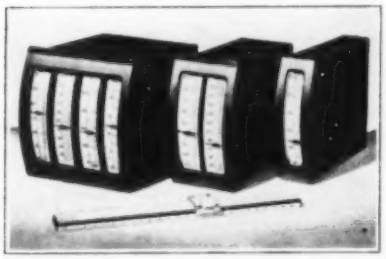
**are built to stand long trouble free service. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.**

**THE FILER & STOWELL COMPANY**
**MILWAUKEE 7, WISC.**

corporation into existing installations or for use in new pipe line assemblies.

## Tamblyn Sales Manager For Hough Co.

The Frank G. Hough Co., Libertyville, Illinois, announces the appointment of G. A. Tamblyn as Sales Manager. Mr. Tamblyn has been with the company 11 years and has been Assistant Sales Manager since 1948. He brings to his new position a broad knowledge of the company's "PAY-LOADER" tractor-shovels and tractors, as well as of their applications, markets and of the Hough Distributor organization.



## Space Saving Indicators for Panel Mounting

411

The Dickson Co. has developed a unique series of vertical scale indicating instruments, know as Dickson MINDICATORS. Specially designed for panel mounting, these multiple purpose gauges are used on graphic or process control panel boards as receivers and as direct reading gauges and thermometers.

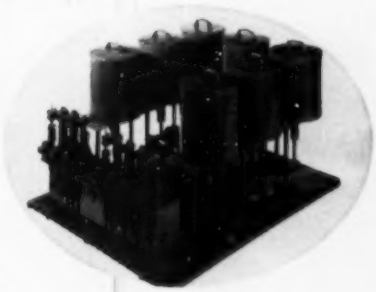
These new instruments are said to be unique in their interchangeability of all parts and complete assemblies. The versatility, accuracy and compactness provide many uses for vertical scale indicators, limited only by requirement for necessary, accurate operating information. Mindicators offer the solution of many vexing instrumentation problems, particularly great savings in instrument panel board and equipment design. The cost of installation and maintenance of Mindicators is said to be very low.


# UTMOST PROTECTION

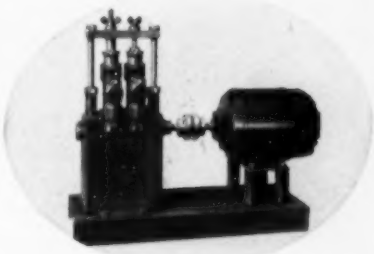
*at lowest cost*

*Manzel* CHEMICAL FEEDERS and HYPOCHLORINATORS

To the cost-conscious water and sewage treatment plant Manzel Feeders pay dividends in accuracy, dependability, and *surprising* economy of purchase and maintenance. Built by an organization famous for fifty years in the manufacture of automatic force feeding equipment, Manzel design is *thoroughly* proven. Whatever your feeding problem, ask Manzel.

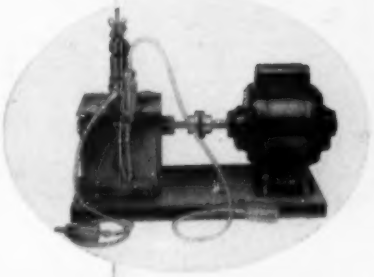


**MULTI-FEED CHEMICAL FEEDERS**
Any number of pumping units can feed the same or different chemicals simultaneously.



**LARGE OR SMALL CAPACITIES**
Various models pump from a fraction of a drop to 60 gph. All types of drives are available.

**MANZEL HYPOCHLORINATORS**
Positive, precise, and *low cost.* Easy to install and service.



***Look at these Quality Features***

- **Full control** . . . *accurate adjustment from 0 to full feed.*
- **Wide range** *of feed covers nearly every job.*
- **Positive in action** . . . *no clogging.*
- **Sight Feed** *and solution strainer.*
- **Easily adjusted** *while running.*

*Manzel*

243 Babcock Street, Buffalo 15, N. Y.

Of the many features of Mindicator design, accuracy, legibility and compactness are outstanding. All units have an exceptionally legible 4" scale, yet require a panel opening of only 5⅜" x 1½" for single units and 1⅜" additional width for each unit added to a multiple housing. Thus, a four-unit multiple requires a panel opening of only 5⅜" x 5⅝", an area less than that required for one average size dial indicator.

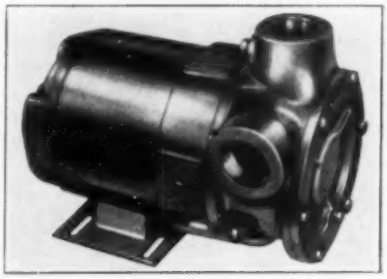
## Tincknell Elected Treasurer of Chain Belt

Chain Belt Company, Milwaukee, Wis., has announced the election of F. Dier Tincknell as treasurer. Mr. Tincknell succeeds George M. Dyke who has retired as treasurer after thirty years of service with the company. Tincknell has been identified with its division of finance and accounts since joining the firm in 1943 and was assistant treasurer prior to his recent election.

## Golden-Anderson Acquires Imperial Machine Works

Golden-Anderson Valve Specialty Company, Pittsburgh, Pa., has acquired the shop and equipment of Imperial Machine Works, Inc. The increased production facilities of this new addition, which contains over 20,000 square feet of usable floor space, were needed to take care of the heavy demand for Golden-Anderson products.

In 1952, Golden-Anderson Valve Specialty Company achieved the largest sales volume in the history of the company. Grant A. Colton, president, attributes this to an ever-increasing demand for automatic valve applications.



## Close-Coupled Turbine-Type Pumps

412

Aurora Pump Co., Aurora, Illinois, has announced a line of Apco V-type Close-Coupled Turbine-Type pumps with mechanical seals in capacities 3 to 30 g.p.m. and heads from 0 to 250 feet.

The pumps, because of close-coupled design, effect a reduction of the pump-motor assembly to small over-all size. The pump and motor shaft are integral, thus avoiding coupling noise and misalignment troubles. Four different positions for suction and discharge connections make installation flexible and easy.

The Apco pump is very simple—cover, inner ring and impeller are the only wearing parts and are made of bronze. These pumps have a high suction lift, 28 feet (at sea level) and will handle vapor entrapped in liquid without losing prime or becoming vapor bound.

## Fairbanks-Morse Promotes William B. Morse

Fairbanks-Morse & Co., Chicago, Ill., has announced the appointment of William B. Morse, formerly Assistant to the Manager of the Detroit, Michigan, sales and service branch of the company, as Manager, succeeding E. J. Hay, deceased.

Mr. Morse is a great-grandson of the founder of the company and son of Robert H. Morse, Jr., President. He has been with the company since 1946, starting in the Beloit Works. From 1948 to 1951 he was a salesman for the San Francisco Branch, which position he filled successfully until his transfer to Detroit in the fall of 1951.

water is important to everybody...

The Miss at this fountain of youth would be mighty disappointed if low water pressure were suddenly to deprive her of a drink—and so would millions of others who take water pressure for granted. One of the best, and least expensive ways to assure the constant flow of water is through Centrilining.

The Centriline process thoroughly cleans and centrifugally applies cement-mortar to the interior of pipe lines in place—prevents corrosion, tuberculation and leakage; minimizes interruption of line operation and street traffic. For an effective, economical means of increasing flow capacity, look to Centriline.

Write for free booklet today.

CEMENT-MORTAR LININGS FOR PIPES IN PLACE

2,500,000 FEET OF EXPERIENCE

CENTRILINE CORPORATION

*A subsidiary of Raymond Concrete Pile Co.*

140 CEDAR STREET, NEW YORK 6, N. Y.

*Branch Offices in Principal Cities of United States and Latin America*

## Ion-Exchange Reactor

413

Enley Products, Inc., New York, N.Y., has developed the "PUP" Reactor for Ion-Exchange. Virtually a new concept of engineering design, the "PUP" (P.U.P. for Plastic Unit Process) is claimed by the manufacturer as capable of doing everything in Ion-Exchange.

The unit is sturdily constructed throughout of high temperature du Pont "Lucite" acrylic resin, and offers excellent chemical resistance plus clarity. It is designed to be used individually or in multiple units for simple or complex Ion-Exchange processes. The reactors are available in two sizes and 3 heights.

## Bailey Meter Promotes G. M. Wallace

Bailey Meter Co., Cleveland, Ohio has announced that G. M. Wallace, manager of the Company's Denver district, has been appointed an Assistant Sales Manager with headquarters in Cleveland. He will supervise the sale of meters and control equipment to the process industries.

Mr. Wallace started with the company in 1940, and became manager of the Denver district in 1945. He is a graduate of Rensselaer Polytechnic Institute, Troy, New York, and a member of the American Society of Mechanical Engineers.

Performance is PROOF

A large filtration plant Superintendent has this to say,

"For coagulation of high turbidity with a high PH we have found Ferric Sulphate to be superior in all cases and we would not hesitate to recommend it."

TENNESSEE CORPORATION

Ferri-Floc

FERRIC SULPHATE

Ferric Salts have proven their ability to coagulate waters of widely varying turbidity. Spring rains bring about turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is partially hydrated Ferric Sulphate that has the ability to convert these high turbidities without radical dosage changes.

**FREE LITERATURE**—Let us send you without cost, our new booklet on economical and efficient coagulation. Just send a card or letter to Tennessee Corporation, Grant Building, Atlanta, Georgia.

TENNESSEE CORPORATION

617-29 Grant Building, Atlanta, Georgia

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

**ACTION** *proves* **MARLOW PUMPS** *are the* **BEST** *. . . for dependable, low-cost performance!*

**Again Marlow gets the job!***

*23 Marlow Plunger Sludge Pumps Installed at the Southeast Sewage Treatment Plant, San Francisco, Calif. —for re-circulation, draw-off and transfer of sludge.

ONCE MORE—Marlow Pumps are relied on for dependable, low-cost performance. Already over 400 municipalities, across the country, have installed Marlows because they are efficient, reliable and durable. They are built for the hard jobs and give that extra "plus" when constant pump performance counts most.

***At the Southeast Sewage Treatment Plant, Marlows do a complete job:***

- **re-circulating sludge in digesters and transfer of sludge between digesters**
- **draw-off of sludge from digesters at a steady rate**
- **transfer of processed sludge from one elutriation tank to another**
- **transfer from final elutriation tank to vacuum filters**
- **transfer of raw sludge from thickening tanks to holding tanks or digesters.**
- **re-circulation of raw sludge in holding tanks or between holding tanks and receiving and thickening tanks.**

Marlow Plunger Sludge Pumps are the direct result of many years of "on-the-job" research and development. They have set the pace for design refinements to meet job specifications.

**Available in simplex, duplex, triplex or quadruplex assembly. 360 to 30,000 GPH capacity.**

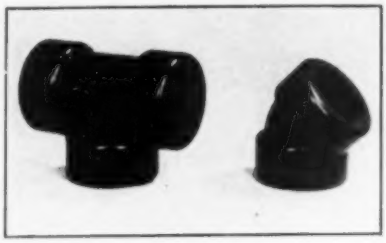
**Write for details today.** 105

• Remember . . for pumping sludges or heavy industrial wastes Marlows do the job better because they are designed and built better. Marlow *means* good pumping.

**MARLOW PUMPS** RIDGEWOOD, NEW JERSEY

Branch Plant: De Queen, Arkansas

Other factories in France and England. Distributors and Dealers everywhere.



## New Heat-Resistant Hard Rubber Available for Many Applications

414

American Hard Rubber Company, New York, N.Y. has developed Ace Tempron, a new synthetic hard rubber compound that now makes even greater the chemical resistance, strength, and economy of hard rubber available for sustained high-temperature applications in handling many corrosive solutions.

Based on nitrile synthetic rubber (Buna-N), Tempron is a hard rubber, and has greater rigidity, heat resistance and chemical resistance than the hard and soft nitrile rubber compounds hitherto available. At present Tempron is available in four forms: (1) Pipe and fittings; (2) Molded parts, with limitless design possibilities; (3) Sheet, rod and tubes from which a wide variety of shapes can be machined or fabricated; and, (4) a hand-fabricating process for making tanks, large fittings, etc., by forming sheets of Tempron around cores or mandrels while still in the soft state prior to vulcanization.

## Diamond Alkali Promotes Belville and Lewis

Diamond Alkali Company, Cleveland, Ohio, has announced new assignments for two members of the Diamond Alkali Company sales organization, Justus U. Belville and Kemble S. Lewis.

Mr. Belville became staff assistant to J. C. Forsyth, manager of Alkali Specialty Sales at the company's general headquarters in Cleveland; and Mr. Lewis becomes assistant manager of Diamond's Chicago Branch Sales, the position formerly held by Mr. Belville.

To his new post in Cleveland, Mr. Belville brings a business background which includes experience in both the alkali specialty and general chemicals sales fields. A graduate of Colgate University, he joined Diamond in 1941, doing merchandising and specialty sales and service work in the Pittsburgh, Pa., area.

In 1950, Mr. Belville was promoted to assistant manager of the sales office, which embraces Chicago and Midwestern states, a post he held until his recent appointment to Cleveland.

Mr. Lewis has been associated with Diamond since 1947, when he joined the Chicago Branch Sales Office to do technical sales and advisory work on Diamond chemicals for the paint-manufacturing industry.

A graduate of the University of Michigan with an M.S. degree in Industrial Engineering, Mr. Lewis is also a veteran of World War II, having served as an army officer with the Chemical Warfare Service and the O.S.S. from 1941 to 1946.

## New Colors For Rustrem Paints

415

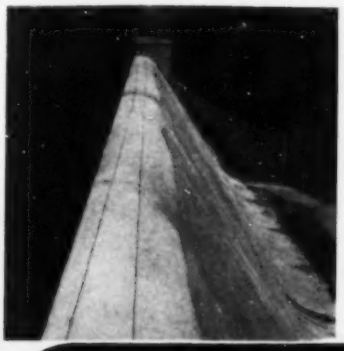
Speco, Inc., Cleveland, Ohio, has announced the expansion of the line of Rustrem anti-rust paints to include three new colors.

Now available in red, gray and green, in addition to the standard black, aluminum and clear, Rustrem stops rust completely in one application, according to the manufacturer.

For use on all metals, both indoors and out, new Rustrem colors are said to eliminate the necessity for a clear base coat except where other paints are desired as finish coats. As with standard colors, the new colors can be applied right over rust without wire brushing, scraping or sandblasting. They are said to penetrate rust layers and adhere tightly to surfaces beneath, forming a tight seal which resists moisture, temperature changes, chemicals, acids and fumes.

Another Rustrem feature is that it can be effectively applied over

(*Continued on page* 124A)



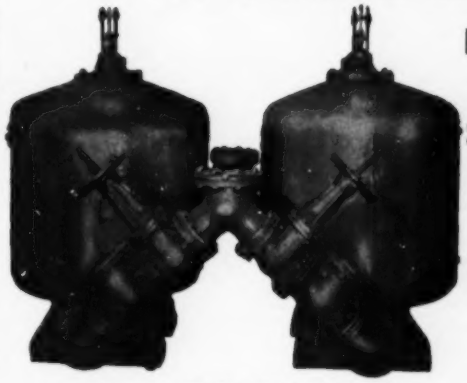
**DAM REINTEGRATED WITH "GUNITE" BY CEMENT GUN CO.**

Photograph above, left, shows Cement Gun Company crew preparing the spalled and disintegrated downstream side of a Virginia municipal hydro-electric dam for "Gunite." The "Gunite" was applied over reinforcing mesh to a depth of 2 inches greater than the original lines of the dam making the structure stronger and more durable than when it was originally built. To insure years of trouble-free service, "Gunite" was also applied on the upstream side to eliminate seepage through the dam. The finished job is shown in photograph below, left.

Completely pictured and described in our latest catalog, are many instances of dam construction and repair together with many other types of "Gunite" jobs we have done. A request, on your letterhead, for Catalog C2400 will bring your copy by return mail.

**CEMENT GUN COMPANY**
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

**OVER 50 YEARS EXPERIENCE —Yet as modern as tomorrow...**



**BLACKBURN-SMITH PNEUMATIC SEWAGE EJECTORS**

**TO LIFT SEWAGE AND SLUDGE AT TREATMENT PLANTS**

**30 to 500 GPM in both single and twin units against high discharge heads.**

**Duplex Sewage Ejector, showing inlet piping.**

Over 50 years service has proved the rugged worth of Blackburn-Smith Ejectors. Yet our today's product is full of exclusive modern features such as:

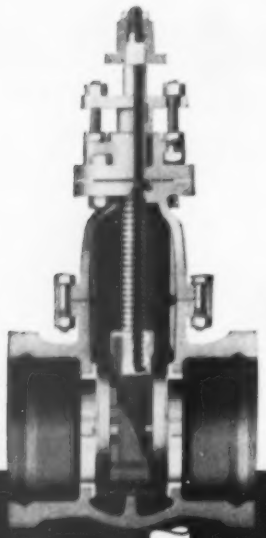
1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve.
3. Electrode controls.

Any one of the above, with or without Air Receivers.

Preferred by most prominent consulting engineers as less messy, more sanitary than centrifugal submerged type sewage ejectors or pumps. Ends screen and pump cleaning. Sewage can be lifted straight up—150 feet—any capacity—once a minute, without fail. Catalog S 50

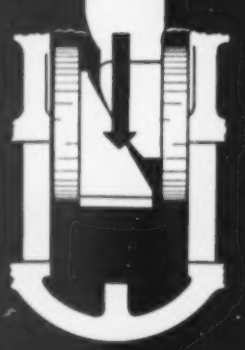
*REPRESENTATIVES WANTED. ADDRESS:*

**BLACKBURN-SMITH MFG. CO. 92 River St. HOBOKEN, N. J.**

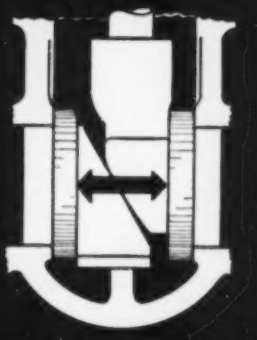


# Look how you gain LONGER, TROUBLE-FREE VALVE LIFE

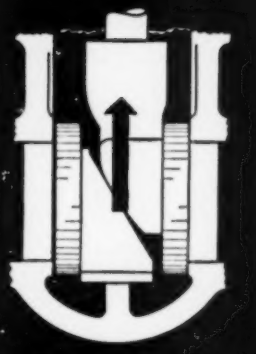
## with Darling revolving disc gate valves*



**DESCENDING.** Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



**CLOSED.** Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and *tight closing despite valve body distortion.*



**RISING.** Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation, tight closing and greatly prolonged valve life!

***DARLING REVOLVING DISC GATE VALVES FOR EVERY NEED.**

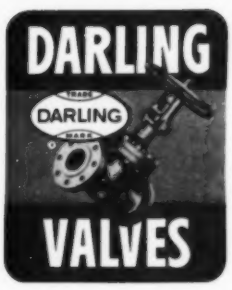
These unique Darling valves are available in a broad range of sizes and types, manually or motor operated, for all normal or unusual services. Before you invest in *any* valves, find out what you stand to gain by using the proper Darling valves on your job. Simply outline your service needs for specific data . . . or . . .

ASK FOR BULLETIN No. 5002

## DARLING VALVE & MANUFACTURING CO.

**Williamsport 11, Pa.**

*Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario*




**FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN**

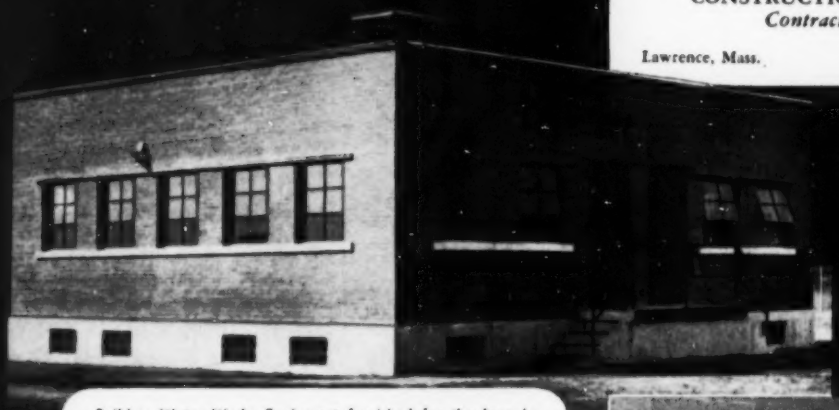
# LACONIA, N. H.

## Sewage Treatment Plant

(Completed in 1952)

**METCALF & EDDY**
*Consulting Engineers*
Boston, Mass.

**MASSACHUSETTS NORTHERN CONSTRUCTION CORP.**
*Contractors*
Lawrence, Mass.



Builders Water Works Equipment furnished for the Laconia Sewage Treatment Plant:

**Model DVSX-M Volumetric, Solution-Feed Manual Chlorinizers**
**CTF Chronoflo Transmitter**
**CRB-TSIR Chronoflo Totalizer, Indicator, Recorder**
**CRB-I Chronoflo Indicator**

The design of the plant required careful consideration of the problems arising from wide seasonal fluctuations in population. Although designed to handle an average treatment load of 1.6 MGD, this plant has a maximum capacity of 6 MGD to meet Summer vacation treatment loads.

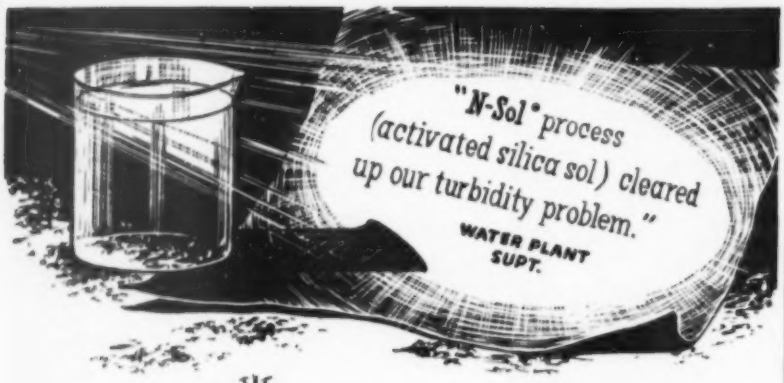
The treatment process consists of primary treatment, separate digestion, and chlorination. Builders Visible Flow Chlorinizers perform the chlorination function in the new plant. These specially engineered Chlorinizers were factory-equipped with dual Sightflo Indicators to cover the wide chlorine flow ranges without further modification. For Bulletins describing Builders Water Works Equipment, address Builders-Providence, Inc. (Division of B-I-F Industries), Providence 1, Rhode Island.

B-I-F INDUSTRIES

**BUILDERS PROVIDENCE**
*Instruments*

BUILDERS

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.




Water, treated by N-Sol Process, sparkles like spring water. This coagulant aid used with alum or ferric salts, produces larger, denser, faster-settling floc than either coagulant alone. Clear effluent results (turbidity often reduced to as low as 1.0 to 0.5 ppm).

Investigate now how an N-Sol Process lowers turbidity. Used widely also for improving color removal.

N-Sol® Processes
PQ SOLUBLE SILICATES

*N-Sol patented processes for preparing activated silica sols from our "N" Silicate of Soda are licensed without royalty.*

PHILADELPHIA QUARTZ COMPANY • 1166 Public Ledger Building, Phila. 6, Pa.

TRIPLE REASON for installing
W. S. ROCKWELL VALVES

*Sizes to 120" for any application.*

W. S. ROCKWELL COMPANY
BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES
2763 ELIOT STREET • FAIRFIELD, CONN.
*Sales Representatives in Principal Cities*

damp surfaces. The paint penetrates through moisture and adheres firmly to the metal below. Because it contains new all-weather solvents which do not thicken appreciably in cold weather, Rustrem is reputed to be ideal for winter use. According to the manufacturer, one coat rustproofs for years.

## Foxboro Announces New Kansas Branch

The Foxboro Company, Foxboro, Mass., has opened a new branch office at Wichita to serve instrument users in the Kansas area. Located at 2207 South Pinecrest, the new branch brings the Foxboro total to 42 offices within the United States, reflecting the growing demand for instrument engineering in all phases of industrial processing.

Appointed resident engineer at the Wichita Office is Mr. Dale G. Hugley, who moves to his new assignment after several years of service with the Tulsa Branch as Industrial Engineer. Well known in the oil and gas industries, Mr. Hugley is a graduate of Oklahoma A & M and has had extreme experience in the application of instruments in industry.

## Rust Preventive Coating

416

L. Sonneborn Sons, Inc., New York, N.Y., has developed a rust preventive coating called S.R.P. (Sure Rust Prevention).

S.R.P. is a specially formulated rust preventive coating containing an active corrosion inhibitor of the chromate type, a laminated, micronized, diatomaceous iron oxide pigment, uniformly dispersed in a specially processed oil-base vehicle.

When applied to old rusted metal surfaces, S.R.P. penetrates through the existing rust, bonds with the clean metal below, and "plates" the surface with a non-porous, elastic coating which passivates the rust already formed, inactivates it and checks its further spread to unaffected areas.

The only preparation necessary to apply S.R.P. over rusted surfaces is wire brushing. S.R.P. can be applied with brush or spray.

## Oliver Filters Opens Los Angeles Office

Oliver United Filters Incorporated, New York, N.Y. has announced an arrangement for local sales and engineering representation in Southern California, Arizona, Nevada and New

Mexico. R. H. Stampley, long with the Oakland Office, has been assigned to this territory, with offices in the Statler Building, 900 Wilshire Blvd., Los Angeles. Telephone: Madison 9-3490. This new office will operate as a direct branch of the Western Sales Division, Headquarters at 2900 Glascock Street, Oakland 1, California.

## Universal Concrete Opens Miami Plant

Universal Concrete Pipe Company, Columbus, Ohio, has announced the opening of a new plant at 1525 Stirling Road, Dania, Florida.

The new plant will manufacture plain pipe in diameters from 4 to 24 inches and reinforced pipe from 24 to 156 inches in eight-foot and longer lengths. In addition, the plant will manufacturer Flexicore roof and floor slabs and other precast concrete products to serve southern Florida below Lake Okeechobee.

## Executive Changes At Chain Belt

Chain Belt Company, Milwaukee, Wis., has announced the appointment of three new Company officers.

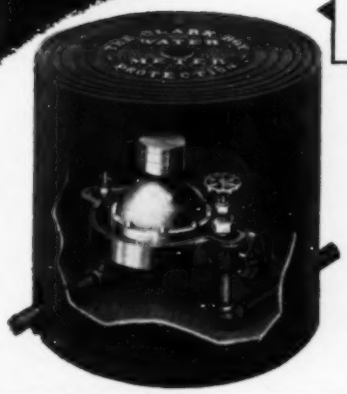
Luther H. Bosnian will be vice president in charge of manufacturing facilities. Mr. Bosnian became associated with Chain Belt in 1919 and has been active in planning the company's present ordnance operations for products similar to those made during World War II.

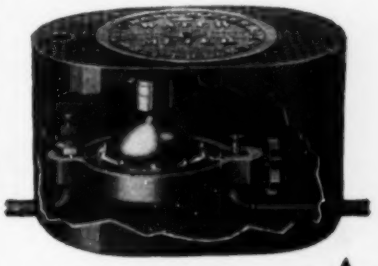
Lyman Newton was elected controller to succeed the late A. F. Kessler. An investment counselor prior to his joining the firm in 1940, Mr. Newton most recently served as chief accountant of the firm's Baldwin-Duckworth Division in Springfield, Mass.

F. D. Tincknell, who joined Chain Belt in 1948, has been made assistant treasurer. He formerly served as tax supervisor for the company and before starting with the company, was active for many years in public accounting work.


CLARK METER BOXES AND COVERS
OF CAST IRON

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.





Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

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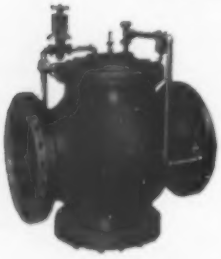

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Pipe sizes 2" thru 24"

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## Cartridge Demineralizer

417

Penfield Manufacturing Co., Meriden, Conn., has announced the availability of a new Permanent Cartridge Demineralizer with exclusive Flow Meter for users of up to 10 gallons per hour of high purity water.

Designed to attach to any wall, near a tap, the new unit is equipped with the Flow Meter, a sight indicator that enables the operator to adjust flow-through to the proper rate for producing water comparable to distilled in solids-free purity.

Operating on the ion exchange principle, the demineralizing cartridge is easily removed and refilled. An electric conductivity-meter is built into the unit to provide continuous visual indication of the quality of the treated water, and warning when the resin charge should be renewed.

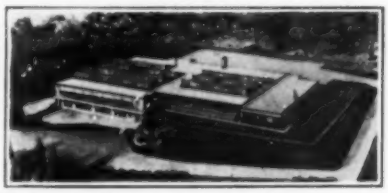
## A. I. Thorsen Named to New Allis-Chalmers Post

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced that Arnold I. Thorsen, works manager, Norwood Works, has been appointed assistant director of manufacturing of the company's general machinery division.

Thorsen returns to Milwaukee after being at the Norwood Works for 12 years. In April, 1940, he was transferred from Milwaukee to the Norwood plant as assistant works manager and four years later was named works manager. He joined the company in 1926 as a drill press operator.

Mr. Thorsen will assist in directing and coordinating manufacturing operations in the firm's general machinery plants located in Milwaukee, Wis.; Norwood, Ohio; Boston, Mass.; Terre Haute, Ind.; Lachine, Quebec, and St. Thomas, Ontario.

J. F. Costigan, assistant works manager at Norwood, has been named the new works manager replacing Thorsen.



## Factory Space Doubled At Foxboro's Montreal Plant

The Foxboro Company, Foxboro, Mass. has announced a new plant extension by The Foxboro Company, Ltd., Montreal, Can., that more than

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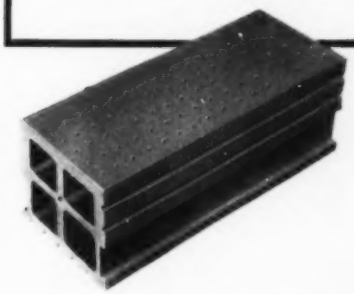
**Glazed Tile**

**FILTER BOTTOMS**



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In this design, laterals and distributing blocks are combined in one permanent unit that insures uniform filtration over the entire filter bed and equal distribution of the wash water with minimum loss of head. The individual blocks—each about two square feet in area and weighing approximately 100 pounds—are made of highest quality de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, and are impervious to acids and alkalis.

Adaptable to any rectangular filter unit, the efficient Leopold Filter Bottom needs only a shallow depth of small sized filter gravel to support the filtering medium. Further, the Leopold design does not require special supporting concrete members or the added concrete construction of a false bottom.

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doubles its instrument manufacturing facilities in Canada.

Matching the original building in arrangement and appearance, the new section is of modern steel and brick construction, with spacious window area and sawtooth skylights. It adds 23,000 square feet of factory space for the production of instrument parts, assembly of instrument panels and cabinets, storage of materials, and for enlargement of the plating, finishing and shipping departments. An additional 5000 square feet on a lower level provides a new cafeteria for employees and training school facilities for customers' men, who are instructed in the proper use and maintenance of Foxboro Instruments.

## Letchfield Elected to Board of Oliver United Filters

Oliver United Filters, Incorporated, New York, N.Y., has announced the election of Francis T. Letchfield to its Board of Directors, replacing John B. Keating, retired.

Mr. Letchfield is a consulting engineer and Assistant Vice-President of Wells Fargo Bank & Union Trust Company with which he has been associated since 1926.

Since graduating from the College of Engineering, University of Michigan, he has had many years of executive engineering experience, both domestic and in the Far East, as well as with the Ordnance Department U. S. Army.

## Carr, Jr., Elected Vice President of Dearborn

Dearborn Chemical Company, Chicago, Ill., has announced the election by the Board of Directors of Robert F. Carr, Jr., as Vice President of the Company.

Robert F. Carr, Jr., will make his headquarters in Chicago and will work with the present heads of the Company's sales departments to promote the general over-all sales of all Dearborn products.

He began his tenure of service with Dearborn Chemical Company in 1934, after attending Hill School and the University of Illinois.

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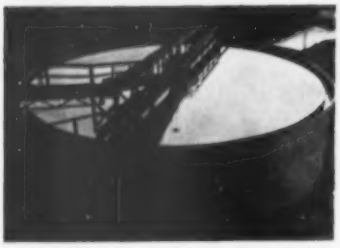

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## Literature & Catalogs

### Regulator Selection Chart

418

Foster Engineering Company, Union, New Jersey, has just published a new illustrated **"Step Selection Chart"** that simplifies selection of the proper type and size of Pressure Regulator, Temperature Regulator or Pump Governor to do a specific job. The booklet is written in non-technical language, and supplemented by Steam, Gas and Water Capacity Tables, together with installation suggestions and other useful information.

### Flexible Tubing Catalog

419

Flexible Tubing Corporation, Guilford, Conn., has available a catalog on **Spiratube A, and R,** the flexible tubing for ventilation, fume and dust removal, and materials handling. This 8-page catalog gives detailed information on Spiratube A and Spiratube R, two types of highly flexible lightweight tubing made from continuous helical coils of spring wire wound with overlapping plies of specially-treated multi-coated fabric. Spiratube A is designed for ventilation, dust removal, fume disposal, and similar applications—either blowing or exhausting. Spiratube R, with built-up extra thickness of rubber, Neoprene, or other polymers, is designed for materials handling, current installations carrying such products as hay, carbon black, sugar, cotton, dry cement, flour, and granulated chemicals.

The catalog also describes Flexflyte, smaller-diameter tubing for the same uses as Spiratube. It contains detailed specifications, air friction charts, data on oil and chemical resistance, and application information.

### Small Vertical Pumps

420

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has just released a bulletin on **Small Vertical Pumps** for sidewall or submerged mounting.

Units covered are available in capacities to 250 gallons per minute at heads to 125 feet for coolant circulating, air conditioning, etc.

According to the bulletin, sidewall-mounted units are the mechanical-seal, closed-impeller pump, the


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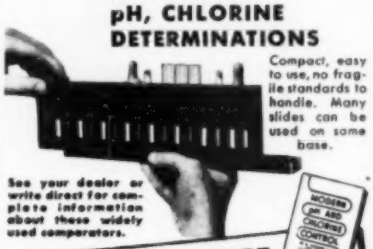

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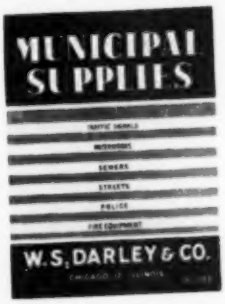

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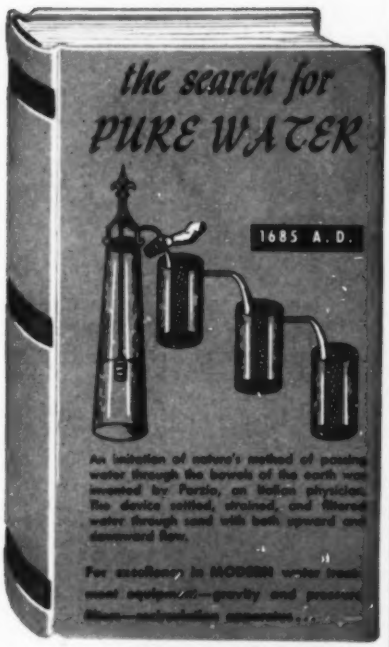


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Darby, Pa.

mechanical-seal, open-impeller pump, and the mounted, sealless, open-impeller pump. Submerged-mounted units are the sealless, open-impeller pump, and the sealless, closed-impeller pump.

Helpful curves and tables to determine motor frame, horsepower, speed and curent characteristics for the various units are included in the bulletin. Also given are construction details of shaft seals and motors.

## Plumbing and Drainage Catalog

421

Josam Manufacturing Co., Michigan City, Indiana, has just published a new **Plumbing Drainage Products Catalog.** A new and exclusive arrangement throughout the 208-page catalog provides quick and easy comparison, selection and specification of plumbing drainage products—helps the specification writer save time and avoid error—assists the user in quickly locating exactly the product he desires.

Especially interesting to architects, professional engineers, plumbing contractors and suppliers is the "visual flow" idea incorporated in this catalog. Base products are shown side by side with all variations illustrated in one view, so that comparison and choice are simple.

The illustrated, alphabetical and numerical indexes have been carefully developed to provide for maximum speed and convenience in using this catalog. Interesting and very helpful information is provided in the form of charts, installation diagrams and illustrations which give the user a great amount of data pertinent to selecting and installing products suited to his particular needs or location.

## Cook Well Strainer

422

The Cook Well Strainer Co., Cincinnati, Ohio, manufacturers of self-cleaning, V-shaped slot well strainers, announce the availability of their new catalog, **No. 1252.**

This catalog is new in every respect and its 48 pages are packed with valuable information concerning the recommended procedure for well strainer installation, uses, etc.

## Tektor Level Control

423

Fielden Instrument Division, Robertshaw-Fulton Controls Co., Philadelphia, Pa., has released an 8-page folder describing the **Fielden Tektor Level Control.**

This 2-color folder outlines the

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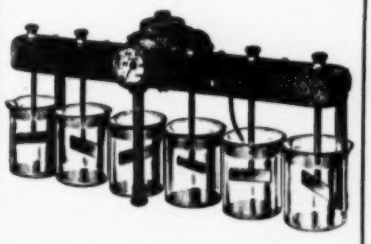

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various applications of the control, stresses its outstanding features (such as no moving parts or diaphragms), and lists the various types of electrodes available. Photographs, line drawings of the control and specifications complete the folder.

## Cost of Field Erected Storage Tanks

424

Hammond Iron Works, New York, N.Y., has available a 16-page booklet on the **Cost of Field Erected Storage Tanks.**

The booklet discusses the various types of tanks including: Cylindrical, Flat-Bottom, Cone or Dome-Roof, Spheres, Bullets, Underground, Elevated and special shaped tanks. Tanks with floating roofs, lifter roofs and diaphragms are also discussed Charts show the cost of each of these different tank types.

## Supporting-Adapter Type, Close-Coupled Pump Bulletin

425

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has released a bulletin showing construction features of **Allis-Chalmers Supporting Adapter Type, Close-Coupled General Purpose Pump** in capacities to 2500 gpm at heads to 550 feet.

Compact and requiring a minimum of space, the pump is available in a choice of packing or mechanical seal, and in a choice of materials, according to the bulletin. It is easy to install, requires only four bolts plus electrical and pipe connections. No special foundation is needed.

Alternate sealing arrangements available are diagramed in the bulletin and a table of dimensions is given.

## Rotary Distributors and Automatic Dosing Siphon

426

Ralph B. Carter Company, Hackensack, N.J., has just published a new booklet on **Carter Rotary Distributors and Automatic Dosing Siphon.**

This attractive 16-page, 2-color booklet presents a detailed description of the various types of Carter Rotary Distributors, including photographs, cutaway drawings and complete engineering drawings.

The section on Rotary Distributor column and arm size selection (page 12) should be of interest and value to engineers. Page 14 starts the section on High Rate Filtration and describes Carter's new KN Process of recirculation, the Jenks Process and the Ward Process.

## Table of Hydraulic Conversion Factors

427

Permutit Company, New York, N.Y., has available a **Table of Hydraulic Conversion Factors.**

This table, prepared by Stanley Lenox of The Permutit Company, is an attempt to make friction, velocity and friction head data available for general usage by engineers, designers and others who must deal with the flow of liquids or fluids in plastic lined, plastic, and light wall steel pipes.

The tables are based on the following relationships:

1. Velocity is inversely proportional to the area or pipe diameter squared.
2. Velocity head is proportional to the velocity squared or inversely proportional to the pipe diameter to the fourth power.
3. Friction loss is inversely proportional to the roughness coefficient "C" to the 1.85 power and the pipe diameter to the 4.87 power (Wil-

(Continued on page 131A)

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(Continued from page 130A)

liams & Hazen formula). "C" is usually taken as 100 in designing steel and cast iron pipes, and most tables are based on this value.

The inside diameters listed in the table are those currently used by manufacturers such as American Hard Rubber Company and the United States Rubber Co. The roughness coefficients are those usually assumed for the particular material in question. Blank spaces indicate sizes in which a complete line of pipe and fittings is not currently being manufactured.

Although the materials listed are those in widest use at the present time, the factors shown apply to any pipe having the same inside diameter and roughness coefficient.

## Flow Meters

428

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Philadelphia, Pa., has just released a set of 7 new specification sheets in consolidated style that cover the company's flow meter line.

Specification Sheets 241 and 242 cover electric evenly graduated flow meter bodies and mechanical evenly graduated flow meters respectively. Specification Sheets 243 through 247 cover square root flow meter and liquid level meters. Specification Sheet 244 also includes evenly graduated electric flow meters (inductance bridge receivers). Construction and engineering details are included in all specification sheets.

## Asbestos-Cement Filter Bottoms

429

Filtration Equipment Corporation, Rochester, New York, has a folder entitled **Cut Your Filtration Costs.**

The folder describes the new filter bottom as being of revolutionary design with a life expectancy equal to the rest of the filter plant itself. Ease of assembly and installation are also discussed. Photographs of installations and complete specifications complete the folder.

## Demineralization and Silica Removal by Ion Exchange

430

Permutit Company, New York, N.Y., has prepared a 28 page bulletin titled **Demineralization Including Silica Removal by Ion Exchange.**

The bulletin states that due to its extremely economical operating costs, as compared with distilled water, demineralization and silica removal through the medium of ion exchange resins has come into very extensive use in all phases of industry.

This new bulletin, describes the chief applications, principles of operation, design features, advantages, recommendations and specifications of Permutit's demineralizing and silica removal apparatus and synthetic resins.

## Flexible Tubing

431

Flexible Tubing Corporation, Guilford, Conn., has released a bulletin on **Flexible's Line of Tubing.**

The bulletin discusses the complete line of flexible tubing in diameters from less than 1 to 30 inches. The ducting, made of fabric supported rubber or plastic wound on helical spring wire coils, is lightweight, highly retractable, non-collapsible, non-kinkable, flexible enough to allow up to 180° turns, and requires no installation skill. Uses of the tubing include portable and semi-permanent ventilation service, fume removal, dust collection, and materials

(Continued on page 131A)

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handling, in original equipment designs and maintenance applications. It also includes information on tubing for special applications, and on fittings.

## Transmission Systems For Automatic Control

**432**

Fischer & Porter Company, Hatboro, Penna., has published a new catalog titled **Transmission Systems.**

The catalog describes completely the pneumatic, magnetic, electric, electronic, and electronic-follower transmission systems for use in measurement and control of flow, pressure, liquid level, viscosity, and specific gravity.

The catalog is profusely illustrated and contains performance characteristics and schematic diagrams of the various systems.

## Carlon "L" Rigid Pipe

**433**

Carlon Products Corporation, Cleveland, Ohio, has just published a new 4-page illustrated booklet, **"Carlon 'L' Rigid Plastic Pipe."**

Detailed information is presented on how sections of CARLON "L" are joined and how they are connected to metal fixtures or established metallic pipe lines. Dimensional drawings and descriptions are included of the CARLON plastic fittings made for use with rigid plastic pipe. Covered in detail is the new compression coupling which has been developed to provide added flexibility, relieve contraction and expansion stresses on long runs of pipe, compensate for changes caused by temperature variations, and assure leakproof connections in lines having relatively high pressures.

Specifications are listed for standard and extra heavy CARLON "L" pipe in sizes from ½ to 2 inches.

## Pressure Pipe Check Sheet

**434**

Price Brothers Company, Dayton, Ohio, has just published a 4-page folder, **"Pressure Pipe Check Sheet,"** that lists all of the requirements for proposed water supply lines in simple question and answer style. Answers, showing how Price Prestressed Concrete Pipe, AWWA Spec C301-52, meets these requirements, are given for all the questions. After reviewing the basic requirements in the folder, you can evaluate each type of pipe under consideration by filling in the handy check list on the cover.

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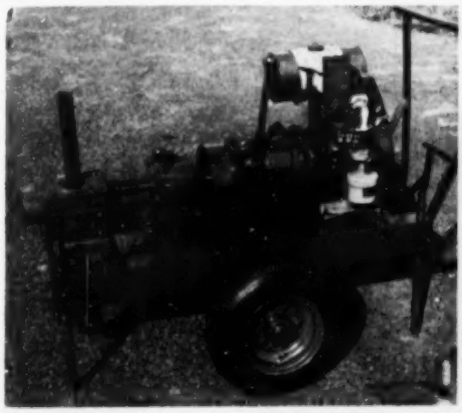

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|---|---|---|---|---|
| 4 | 2.5 | 2.00 | 2.25 | 8.56 |
| 6 | 2.5 | 3.00 | 2.25 | 11.71 |
| 8 | 2.5 | 4.00 | 2.25 | 14.63 |
| 10 | 2.5 | 5.00 | 2.25 | 17.70 |
| 12 | 2.5 | 6.00 | 2.25 | 20.86 |
| 14 | 2.5 | 7.00 | 2.25 | 24.02 |
| 16 | 2.5 | 8.25 | 2.25 | 33.07 |
| 18 | 2.5 | 9.25 | 2.25 | 36.88 |
| 20 | 2.5 | 10.50 | 2.25 | 40.71 |
| 24 | 2.5 | 13.00 | 2.50 | 53.02 |
| 30 | 2.75 | 16.00 | 2.50 | 65.36 |
| 36 | 2.75 | 19.00 | 2.50 | 77.96 |
| 48 | 3.50 | 30.00 | 3.00 | 121.15 |
| 54 | 4.0 | 38.00 | 3.00 | 135.60 |
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## Clay Products Catalog

435

American Vitrified Products Company, Cleveland, Ohio, has just published a complete new **Clay Products Catalog.**

Reputed to be the most comprehensive technical volume ever issued by any manufacturer in this field, the new 98-page booklet includes data on sewer pipe and fittings, perforated pipe, channel pipe, wall coping, flue linings, chimney tops and pots, stove pipe, liner plates, fire brick, fire clay, septic tanks, drain tile, joint compound and die cast sewer joints.

Also listed are A.S.T.M. and Federal specifications, and installation and purchasing hints. The book is thoroughly cross-indexed and is intended for use as both a reference and buying guide.

## "Runabout" Ditcher

436

Barber-Greene Co., Aurora, Ill., has just released an attractive 8-page, two-color folder describing their newly announced **Model 705-B "Runabout" Ditcher.** The 705-B is a wheel mounted unit especially designed for use by utilities, governmental bodies and contractors.

A full double-page spread is devoted to description of the three principal features of the machine; a Chrysler fluid coupling which is combined with the fully hydraulic "Hydra-Crowd" digging transmission which was a feature of the predecessor, Model 705-A; and the special curved tooth bucket line.

Extensive field tests of the special curved tooth bucket line described in the folder, indicate a life expectancy of from three to five times that which is normal for digging teeth. The teeth are easily replaceable and have demonstrated unusual efficiency when digging in sticky soils.

Other features of the 705-B "Runabout" which are pictured in the folder are its 15 m.p.h. road speed; high road clearance, combined with low overall working and traveling height; roomy operator's cab with automotive type controls, counterbalance valve which prevents "creeping" when digging on a slope, plus such accessory units as a hydraulic backfilling blade.

A unique "worms-eye" view of the machine gives a graphic illustration of many additional features.

A number of interesting facts relative to operating costs, together with useful data on the 705-B's digging range, digging speeds, ratios of pipe sizes to trench widths, etc., complete the information contained in the booklet.

## High-Capacity, V-Belt

437

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a new bulletin on high-capacity **"Texrope" Belts** for tough jobs.

According to the bulletin, high-capacity, "Texrope" V-Belts carry 40 percent greater horsepower rating, are oil resistant and static conducting.

The belts are recommended for use in tight spots, for compactness, for changed peak loads, for resisting oil, weather and chemicals, for cutting sheave costs, and where static is a factor.

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## Self-Cleaning Water Filter

438

Sparkler Manufacturing Co., Mundelein, Ill., has just published a folder on the **Sparkler Self-Cleaning Water Filter.**

The folder describes the filter as a diatomite, surface type filter with an exceptionally efficient slurry feeder. Among the features discussed are the built-in jet wash-off and back wash operations.

Photographs show actual installations at both public and private swimming pools. Also included in the folder is a discussion of the Sparkler Automatic Continuous Overflow Closed System. Complete specifications on the various models are also given.

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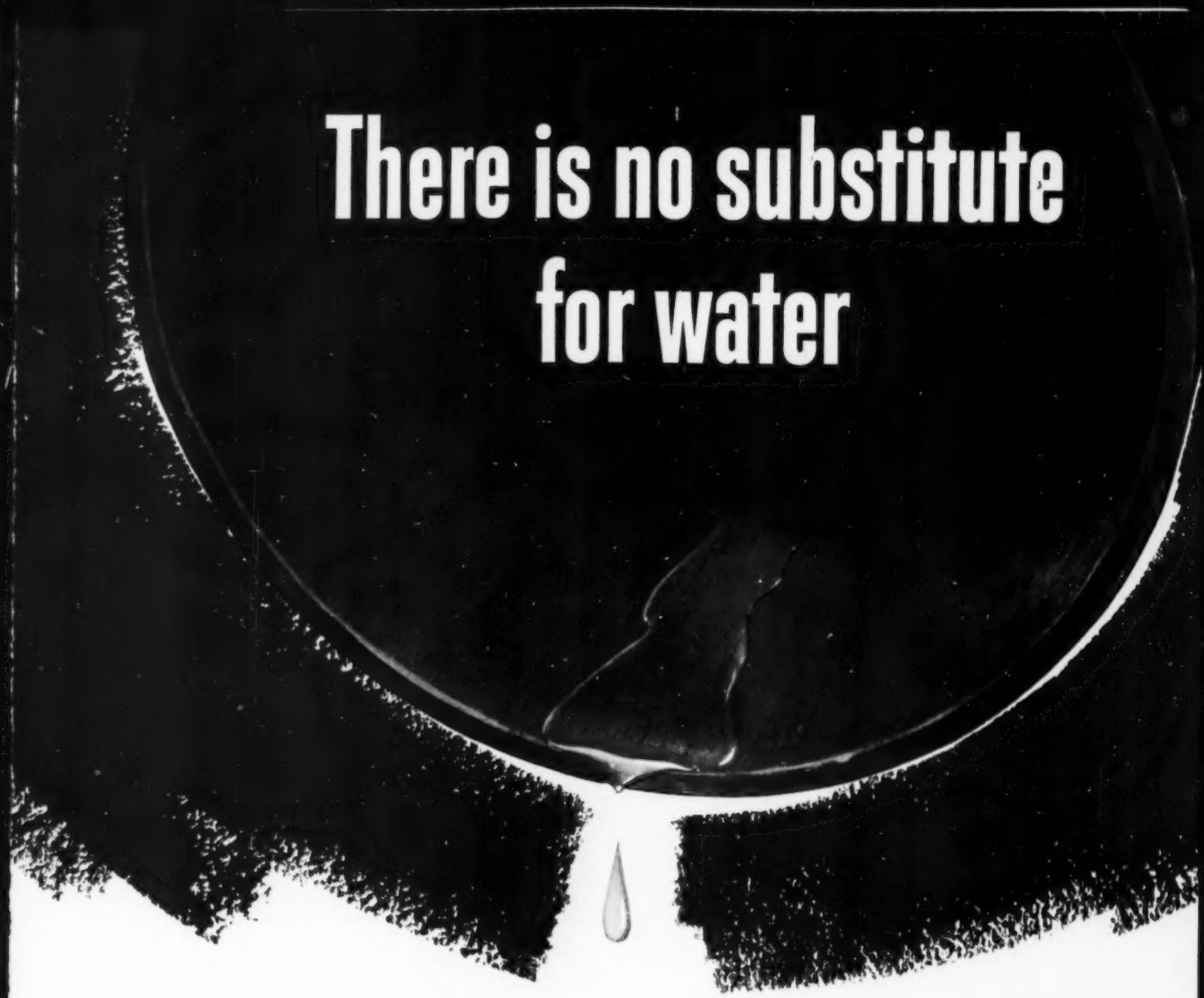
# There is no substitute for water



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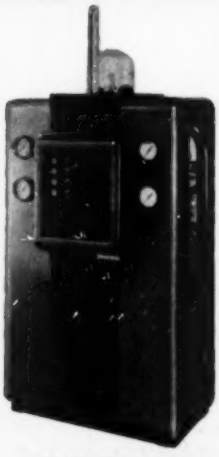

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